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A Prophecy

THE Merchant Marine Act of 1922, with its direct and indirect aids will become a law during this session of Congress for the following reasons: The country is sold on the proposition of an American merchant marine; the necessity for the immediate adoption of a definite shipping policy which will induce private capital to invest in American vessels by giving American ships a chance to compete with foreign vessels on all fours is apparent; sufficient demand, which is as essential as necessity when legislation is to be secured, exists; the bill itself has been worked out on such a conservative and comprehensive plan for encouraging shipping, while at the same time safeguarding the Treasury, that no one has been able to accept the President's invitation to suggest something better.

That the country is sold on a merchant marine is evident from the public endorsements that the Shipping Bill has received from chambers of commerce and trade organizations in the South and Middle West. The testimony of representatives of these organizations who attended the hearings at their own expense for the purpose of informing Congress of their sentiments shows that the country is determined to preserve the trade routes that have been established by the Jones Act. They want a guaranty that American vessels will be kept on these routes for at least five years, and they never again will be willing to risk a congestion in transportation by depending on foreign ships for the carriage of their surplus products.

The necessity for an American merchant marine which Congress recognized in the preamble of the Jones Act when it promised to do whatever was needed to establish American shipping on a basis that would serve the country adequately in peace and war has been acknowledged even by such subsidy opponents as Senator Fletcher. Senator Fletcher stated in an address before the convention of the National Merchant Marine Association that he would support the Shipping Bill, if he could be shown that a subsidy was necessary in order to establish an American merchant marine. The democratic members of the Senate and House committees on merchant marine affairs are cross-examining witnesses in a very exhaustive manner, perhaps in the hope of delaying action until they can make alternative suggestions, but yet fully realizing the fact that a definite shipping policy will have to be adopted.

The demand for this legislation is indicated by the change in editorial policy of several influential Middle West newspapers, by the earnest efforts of 14 States to secure an outlet from the Great Lakes through the St. Lawrence River, by the determination of the Mississippi Valley Association representing 28 States to secure an outlet for agricultural products through the Gulf, by the growing realization of the importance of the merchant marine as a naval reserve and by the efforts of the President himself whose fondest wish is to establish the merchant marine in his administration.

British Propaganda

IT is the firm belief of a great many men of unquestionable integrity that active British propaganda is constantly at work to prevent the proper development of an American merchant marine. This is a fact, and it is chiefly due to the character of the shipping editorials appearing in a large percentage of the American press and notoriously many of those of New York city which have consistently opposed any constructive legislation that would establish our merchant fleet on a profitable basis.

On many occasions the *New York Journal of Commerce* has been open to suspicion on this account but the editorial recently appearing in their columns entitled "Government and Shipowners Incorporated" exceeds in *inaccuracies* and attempted sarcasm anything that has come to our attention. One would think that, if London papers could interpret the Shipping Bill in March, the *Journal of Commerce* ought at least to be able to do it in April, especially in view of the

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able analyses that Mr. Lasker and others have publicly made and which have been literally broadcasted to the press.

This editorial in referring to subsidies says, "It is intended to pay subsidies to vessel owners, who will then carry on business as best they can. In the event that they are successful in making profits above 10 percent, one-half the surplus will constitute a repayment to the subsidy fund. In order to establish the conditions under which the shipping business is carried on, there is thus necessitated an extensive system of accounting and reporting, with allowance for depreciation and the like. This is obviously essential, if there is to be avoidance of concealment of profits or error in the reporting of apparent losses. Such a system of accounting and reporting would require clearly as elaborate a method of segregation as would be essential in any private business."

To comment on this for the benefit of our readers, we take pleasure in explaining to the *Journal of Commerce* that the profit a ship operator makes in excess of 10 percent will be determined by his *income tax return* which will have to be made and audited, subsidy or no subsidy. Chairman Lasker has repeatedly explained that the few hundred ship operators' returns ought not to embarrass the Treasury department who are handling far more complicated questions than checking a ton mileage subsidy with a net income statement. As there is very little likelihood of many, if any, companies making over ten percent, it would appear that there is no occasion to worry about the reliability of the income tax returns. If there is, we have failed to note any anxiety from the press about the taxes that the Government may be losing through the possibility of millions of income tax returns being incorrect. It is conceded that a small number of reporters will be needed to determine the subsidies to be paid by multiplying a fixed speed times a fixed tonnage times a fixed distance at a fixed rate.

The next statement made in this editorial relates to loans to shipowners and it reads as follows: "Obviously, if the Government should go into such an enterprise, it would be a kind of special partner. It would in the first place be a large creditor of the buyers of vessel tonnage, who are expected to purchase on perhaps 15 years' credit. Since the loans are to be made at a nominal figure of possibly two percent either for the carrying of the unpaid sums due on the ships or for furnishing working capital (where that is allowed), the Government will of course have very scant security and will find it needful in any case to keep close track of the methods of operation."

In commenting on this, we utterly fail to understand how our esteemed contemporary, if it has actually taken the trouble to read the proposed law, *could mix up the construction loan fund with the sale of existing vessels and unpaid balances.* In this case, for its information, the proposed law only allows money to be loaned at 2 percent when it is to be used in the construction of special types of vessels, such as passenger vessels, refrigerator ships or motorships which are sorely needed to balance the fleet. Mr. Lasker testified before the hearings that he would not sell the Government vessels without a substantial payment down and that the unpaid balance would draw a commercial rate of interest. Where does the scant security come in on selling vessels at about $30 on such a basis?

After indulging in a few pessimistic inferences regarding the future of the American merchant marine, this patriotic expounder of our shipping policy enumerates what it calls the adventitious (accidentally or casually acquired) indirect aids. It then expresses great concern as to the possible effect that the carrying out of such policies would have on other nations.

The *Journal of Commerce* knows that the Shipping Bill was prepared from the facts and findings of well known marine experts working in conjunction with the Shipping Board. It must also be aware that when the President outlined the exhaustive and comprehensive nature of this proposed legislation, he said if anyone has criticisms to offer of this plan *they should at least suggest something better in its stead.* How then can a daily newspaper supposed to be serving the shipping interests, forty-nine days after the Shipping Bill has been introduced into both Houses of Congress, publish an editorial 16½ inches long without one constructive suggestion and sarcastically criticise the provisions of this bill by basing its logic upon inaccurate statements of the intent of the proposed legislation? This may not be British propaganda but it certainly is not American.

American Marine Association Active

THE American Marine Association, born some fifteen months ago and at the beginning known as the Marine Equipment Association of America, has made rapid strides as a factor in the marine field. Originally it was intended that the chief function of the organization should be to stage an annual marine show; but by degrees its scope has broadened until now it is rapidly assuming the proportions of a chamber of commerce.

The first definite step toward the present goal was taken last year when the association decided to hold its initial exhibit during the week in which the Society of Naval Architects and Marine Engineers held its annual meeting and succeeded in enlisting the hearty cooperation of that organization, which it still enjoys. This was followed in turn by agreements on the part of the American Society of Marine Designers and American Steamship Owners' Association to participate in the efforts of the American Marine Association, made last November, to inaugurate "American Marine Week;" while the Technical Committee of the American Steamship Owners' Association gave its approval by visiting the marine show in a body. Efforts are now being made to enlist the support of other similar bodies.

Following the first get-together in November, the American Marine Association immediately took steps to capitalize its work by revamping its committees, opening a permanent office in New York and renting two floors of the Grand Central Palace for its second annual exhibition (November 4-11), for which it has already booked considerable space. During these activities the association has found time to carry on a campaign for increased membership and perfect arrangements to help to stimulate public interest in the subject of an American merchant marine.

In connection with the last mentioned activity, the association has endorsed President Harding's plan and is taking steps to make its action known to Congress. The opinion

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of the American Marine Association will undoubtedly have considerable weight with those charged with enacting legislation that will mean much to American shipbuilding and shipping, since its membership includes substantially all of the large and many of the smaller American concerns having to do with building and repairing ships and manufacturing the things with which ships are equipped, as well as a number of steamship operating companies whose vessels fly the American flag.

The Proposed Pacific Steamship Combine

ACCORDING to Mr. Lasker's testimony at the hearings on the Shipping Bill, the real object of the board, in suggesting at the time that it did to the shipping and financial interests of the Pacific Coast that a steamship combination having a capital of at least from $25,000,000 to $30,000,000 should be formed to meet the competition of the strongest companies of other countries, was to obtain data and facts from men representing the wealth of the Pacific Coast which could be recited to Congress and which would show a definite case where the passage of the proposed shipping legislation would bring immediate results.

The fact that a group of representative men could be induced to travel across the country to Washington to confer on the possibilities of a shipping combination of this sort, knowing, of course, that it would be several months before a definite shipping policy could be established, ought to be a practical assurance to the American people that results can be obtained.

There are several reasons why the Pacific offers exceptional opportunities for a large company operating combined passenger and cargo ships, provided the President's plans go through. Principally among these are the proposed diversion of the Army transport service to private vessels and the extension of the coastwise regulations to include the transportation service to the Philippines.

At any rate the committee from the Pacific Coast was so much impressed with the possibilities of a great American steamship line on the Pacific that its members were disappointed that the Shipping Board could not make them a definite proposal at the time. The board, however, obtained its object, for the committee voluntarily averred that it would go ahead and form this big steamship company, if the proposed legislation or approximately the proposed legislation is enacted by Congress. They are entirely disinterested, if it is not.

Insurance Syndicates Report

CONSIDERING the depression in business, the fall in tonnage values and the increased competition of foreign companies, the annual statement of the American Marine Insurance Syndicates is very satisfactory. Although Syndicate "B" has done very little business, due to the inability of the Shipping Board to dispose of its vessels, it reports a credit balance of $477,066.74.

The scope of Syndicate "B" is limited to insuring the unpaid balances on Government ships and these vessels cannot be sold except at very low prices, which complicates the question of making good the cost of repairs. In addition to this, the managers have recently agreed that "where a private owner's interest is written in Syndicate 'C' the same rate will be quoted in 'B' for the Government's interest;" where a private owner's interest is placed with underwriters other than "C," Syndicate "B" will quote for the Government's interest the same rates as would have been quoted for the owner's interest if insured with Syndicate "C"; and "that all obligations to place such insurance with 'B' being suspended and the Government and owners being at liberty to place the insurance in the world market if so decided in each case by the Shipping Board."

Syndicate "C" reports a credit balance of $1,251,597.35 which, in view of business conditions, reflects very efficient management. In one instance, the fact that the managers refused to meet the market on the terms offered for insuring the *Northern Pacific*, whose total insurance amounted to $1,250,000, resulted in the absorption of the total loss by foreign companies.

Syndicate "A," or the United States Salvage Association, reports the practical completion of a world wide organization having agents at 88 ports. The work of this syndicate in making damage surveys, assisting in salvage work and other functions similar to those practiced by the London Salvage Association, should be of great benefit to our merchant marine as well as marine insurance companies.

Keep the Navy Properly Manned

THE United States was able to call a Disarmament Conference and to succeed in getting the principal maritime powers to make a treaty ending the mad race for naval supremacy simply because it had an efficient Navy and the potential power of increasing the number of its warships far beyond that which any other nation could do without involving itself in serious financial difficulties. If America had not been powerful on the sea or if she had not been able to sacrifice much more than any other country in the way of naval strength, it is very doubtful whether this long step toward the attainment of a permanent peace could ever have been accomplished.

Why, then, after telling the world that a certain tonnage of capital ships represents an irreducible minimum that this country cannot safely go below, should Congress attempt to reduce the naval personnel to 67,000 when it was stated at the time of the conference that 130,000 men were required to efficiently man our ships on the so-called 5-5-3 ratio? At this writing the House has increased the number of men to 86,000 which is no more nor less than a compromise. As the personnel has to do the fighting an adequate number of trained men is more important than a paper figure of displacement tonnage. Does Congress wish to create the impression that we are going to scrap our Navy anyway, that we made no sacrifice in giving up our best ships, and that other countries have been inveigled into an agreement, our part of which we intended to do notwithstanding the result of the conference?

If such is the case, our legislators certainly do not realize the fact that the Limitation of Armament agreement is only

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an experiment at the best. All thinking men know that the danger of war is not passed but simply reduced. They know that the best insurance not only for this country but for the world against a recurrence of armed conflict lies in the United States preserving a strong influence, backed by reasonable naval power which can be exerted in the proper direction when critical situations arise, as they surely will.

Financing and Expanding Our Foreign Trade

FINANCING and expanding our foreign trade, which will be the principal theme at the ninth National Foreign Trade Convention to be held at Philadelphia, May 10, 11 and 12, is of even more importance to the welfare of our merchant marine than the passage of the shipping bill.

The shipping bill will equalize the differential existing between the cost of operating American and foreign ships but it will not provide the cargoes that must fill these vessels if they are to be profitably employed.

Fortunately, however, America can easily produce more than enough to fill even our surplus cargo ships and by so doing it could increase the purchasing power of our citizens so that they could import an ever increasing amount of the products of other nations.

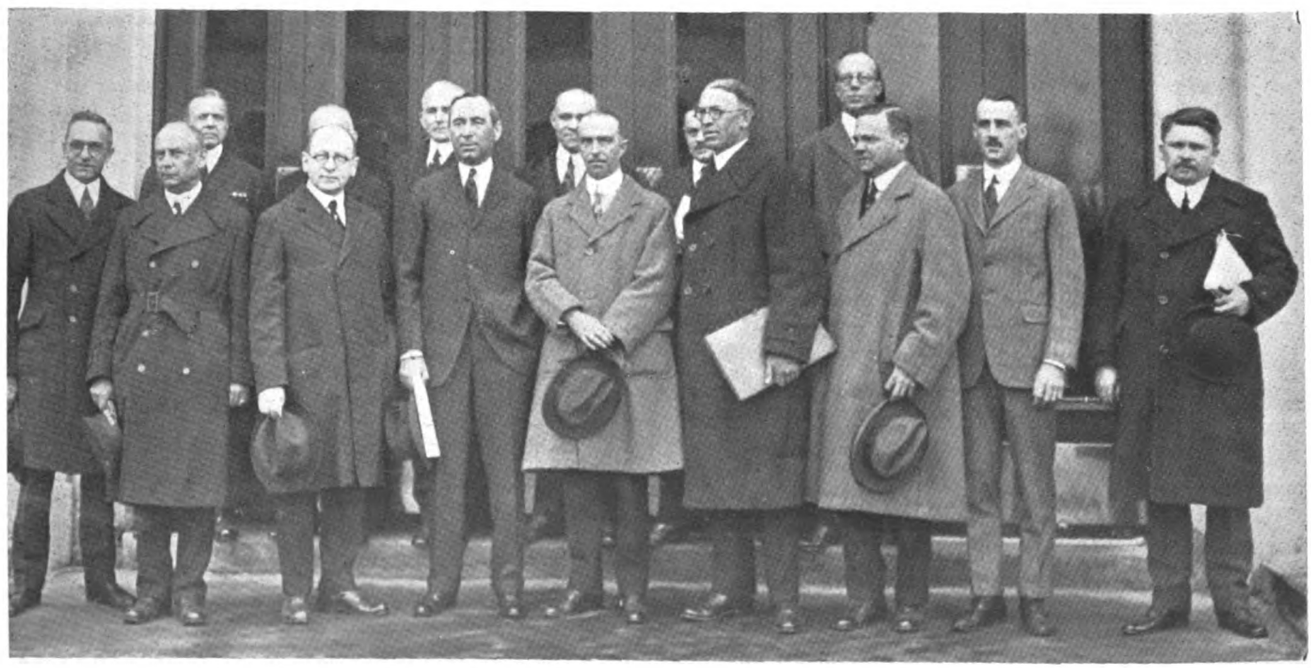
Just as a man who is able to successfully direct a business enterprise that gives profitable employment to a large number of people is a public benefactor, so America could, by financing and expanding its foreign trade on sound business principles, furnish an opportunity for other nations to increase their production, develop their industries and improve their standard of living.

The loss of productive and purchasing power of the several million men who were slaughtered in the world war was a terrible blow to the world's economic structure, but that cannot be helped now. What can be helped on our part is a restriction of production to domestic needs with its consequent unemployment, reduced purchasing power and inevitably lower standards.

It is to be hoped that the Foreign Trade Convention will find a solution of the problem of European credits. Several schemes have been proposed and constructive legislation in the Edge Act has been accomplished, but there remain in South America and the Orient enormous opportunities that have as yet only been scratched.

Japan has spent vast sums of money in this country, which has been of mutual benefit. The insistence of our statesmen that the policy of the "Open Door" shall be maintained is sufficient proof of the value and possibilities of this market. Until the standards in the Orient have been raised to somewhere near our own level the only reason for over production is the lack of brains and courage to direct the development and resources of such countries as China so that the purchasing power of her citizens will be sufficient to allow them to avail themselves of what we consider the necessities of life.

This means the establishment of foreign merchandizing and banking branches on a firm footing and this must be accomplished, if a real merchant marine is to be established and an outlet for our surplus agricultural and manufactured products maintained.



Shipping Board Experts Who Prepared the Ship Subsidy Bill, the Basis of President Harding's Message to Congress and the Legislation Now Pending

Back row, left to right—Rear-Admiral H. H. Rousseau, U. S. N.; Winthrop L. Marvin, vice-president and general manager, American Steamship Owners' Association; John Nicolson; Captain E. E. O'Donnell; T. H. Rossbottom; Daniel H. Cox. Front row, left to right—Captain Irving L. Evans; Rear-Admiral C. S. Williams; Meyer Lissner, commissioner United States Shipping Board; Albert D. Lasker, chairman United States Shipping Board; Elmer Schlesinger; N. B. Beecher; J. B. Smull, R. T. Merrill and Dr. S. S. Huebner.

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Let's Have Protection All Along the Line

By Winthrop L. Marvin

Protection, vigorously applied and adhered to, has made the United States the greatest manufacturing nation in the world. It has the power —as our foreign rivals know full well—to make the United States the foremost ocean shipping nation as well.

IT is well that President Harding's new Shipping Bill comes forward in a Congressional session that is called on to enact also a new protective tariff. This serves to emphasize the fact that national aid is not asked alone for our ocean shipping industry.

What the protective policy has proved to be for manufacturing and for agriculture the Shipping Bill, with its indirect aids and direct compensation, or subsidy, will also be for shipowning and shipbuilding. The two measures naturally and logically go together.

The First American Tariff Protected Shipping

In fact, the very first protective tariff in American history —the law of July 4, 1789, the first law under the Federal Constitution—gave powerful aid to ocean shipbuilding and navigation along with all other American industries of the day. That law fixed a substantial rate of import duty upon virtually all kinds of foreign merchandise, and protected the shipowners, shipbuilders and seamen by a provision that there should be a higher duty by 10 percent on these foreign goods in foreign ships than if imported in American vessels. Furthermore, there was a tonnage tax of 50 cents on foreign and 6 cents on American vessels which gave additional encouragement to the new American merchant marine.

It is a matter of history that this early provision for the protection of shipping and shipbuilding was brilliantly successful—more successful, measured by its actual results, than was the protection simultaneously given to manufacturing and to agriculture. Our tonnage registered for foreign commerce, which was only 123,000 in 1789, had risen to 981,000 in 1810, when we were carrying 90 percent of our own imports and exports in our own ships.

Shipping Our Only Unprotected Industry Since 1861

It is one of the strangest anomalies of legislation that when the Republicans, newly come to power, vigorously reestablished the protective tariff system in 1861 and onward, so far as manufacturing and agriculture were concerned, they did not at the same time extend protection to American shipping. But they did not, though after the war they repeatedly attempted to through various subsidy bills and other expedients. They long found the Democratic party almost solidly opposed to them, together with a faction of Middle Western Republicans, particularly those of German and other foreign descent.

Such protracted Congressional hearings as those before the present joint committee always create an impression that the shipping question is an exceedingly subtle, complex affair. But it is no such thing—as a matter of fact, it is a singularly direct and simple proposition. Ocean shipowning and shipbuilding have not shared the prodigious increase which other American industries have manifested since the Civil War, because ocean shipowning and shipbuilding have been left unprotected—the only unprotected industry of all the range of American industries exposed to foreign competition.

Because of intensive competition, due to the rivalries of maritime governments and peoples, there has actually been more need of protection to the ocean shipping industry than to any other. Yet it has been left on what is virtually a free trade basis. That is to say, except for a few transient mail subsidies to special lines, the American merchant marine in overseas trade has been operating since 1860 without any protection whatsoever, of any kind. There has been no tariff protection and there has been no adequate, sustained subsidy protection that might serve as a substitute.

American People Unwittingly Supporting Foreign Naval Reserves

On the other side, however, among our foreign competitors the ocean shipping industry has been sedulously fostered as has nothing else. Our foreign rivals know well the advantage to them of absolute control of the overseas delivery service of American manufacturers and farmers. They know that the nation which owns the ships has the power to repress American commerce, and that in the long run this is exactly what it will be doing. They know also, these foreigners, that if they can manage to do with their own ships the bulk of our overseas carrying, they are really making us, the American people, support foreign naval reserves that can be turned with deadly force against us in an emergency. This is sufficient to explain the ferocious opposition always offered by various foreign elements in this country to any measure for the upbuilding of a great American merchant marine.

Never before since 1789 have a protective tariff bill and a protective shipping bill been offered together at once for the action of Congress. Never before has it been made so embarrassing for an inland Senator or Representative to vote on one day for a tariff for the encouragement of sheep growing or of wheat growing or of corn growing or of livestock or of dairy products, and then on the next day to vote against a protective shipping bill. It is altogether a very awkward situation for those lawmakers of the interior who have been invoking protection for the benefit of their constituents and have attempted to deny it to the merchant marine.

Opposition of the Agricultural Bloc Broken Up

It is a recognition of this fact that has broken up the anticipated opposition of the agricultural bloc to President Harding's merchant marine bill, on which foreign shipowners and governments were counting with so much exultation. There is a sense of humor as well as a sense of justice among rural as well as among urban Americans.

The basis for protection to the merchant marine is exactly the same as the basis for the protection of manufacturing and agriculture. American wage costs and living standards are higher than those of the Old World. It is this in the last analysis that compels the maintenance of a protective policy in the United States. Our workers expect and need to earn more money to live as Americans should live. Shipowners have to vie with manufacturers and farmers for their workers in the labor markets of our ports and country. It is this hard economic fact far more than the La Follette seamen's law that compels a higher operating cost of American ocean steamers.

A New Form of Customs Tariff

If ocean shipping could be protected by a customs tariff, there is no doubt whatever that American shipping would

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have been a well-protected industry in all the years since 1861. But both President Wilson and President Harding have agreed that there are grave reasons of state why the thirty-odd commercial treaties forbidding tariff aid to American ships should not be disturbed by efforts for amendment. Therefore, it has proved absolutely necessary to resort in the present Shipping Bill to a different method of assistance, which, however, is not so different as it may seem to be. As President Harding declared in his address, referring back to the discriminating duties of the Merchant Marine Act of 1920, "The recommendation of today is based wholly on this commendable intent of Congress. The proposed aid of the Government to its merchant marine is to have its chief source in the duties collected on imports. Instead of applying the discriminating duty to the specific cargo, and thus encouraging only the inbound shipment, I propose that we shall collect all import duties, without discrimination as between American and foreign bottoms, and apply the heretofore proposed reduction to create a fund for the Government's aid to our merchant marine. By such a program we shall encourage not alone the carrying of inbound cargoes subject to our tariffs but we shall strengthen American ships in the carrying of that greater inbound tonnage on which no duties are levied, and, more important than these, we shall equip our merchant marine to serve our outbound commerce, which is the measure of our eminence in foreign trade."

It was the original intent of Congress two years ago to aid American shipping by diverting 10 percent of the customs duties to encourage shippers to prefer American ships. President Harding is absolutely right when he urges that there is no essential difference between diverting 10 percent of the customs duties from the Federal treasury and paying out 10 percent of the customs duties for the purpose of direct encouragement of shipping. This is a proposition to which no reply has ever been made because none could be. The cost of either policy is the same to the American nation. Both embody protection to the overseas shipping industry as a whole.

Quibbling Over the Principle of Subsidies Unnecessary

It is full time that there should be an end forever to abstract discussion of the principle or policy of subsidies. There is no discussion of it whatever by any other nation than our own. Other governments and other peoples, if they wish to protect their merchant marine and naval reserve, go about it in straightforward, manly fashion, without sectional or party division. If it is necessary for them to pay a certain sum of money from the public treasury for the maintenance of a national line of steamers to South America or the Orient, they go ahead and do so without quibbling. If it is necessary and advisable to encourage "tramp" steamers by mileage-tonnage subsidies, these other governments and peoples do so, as notably in the case of France and for years in the case of Japan. They see what they want and believe they need, and they go after it with a precision and an honesty that shame the hair-splitting politicians of America.

American Railroads Built Up by Government Aid

What is the use of attempting to deny or hide the fact that most of the American railroads of today were built by the potency of public aid administered at a time when the public could not afford it half so well as it can today? Without that aid the greater part of our magnificent railroad system would still be non-existent. A dozen years ago a rural newspaper of the West aroused much amused comment in Washington. In parallel columns this rural sheet printed two editorial leaders—one passionately championing the grant of a municipal cash payment to aid the building of a railroad line to a neighboring city, the other violently assailing President Roosevelt's recommendation of a subsidy for American ships on the Pacific and to South America. The ship subsidy was denounced as vicious; the railroad subsidy was eulogized as beneficent and holy. Of course they were both essentially the same thing.

In the long line of successive efforts to secure subsidy in this country for American shipping, there has been just one serious scandal—that associated with the postal subsidy to the old Pacific Mail Company a half century ago, in 1872. This is harped upon today by the foes of shipping subsidies—and most notably of all by the foreign foes—as an argument against the granting of shipping subsidies in this year of grace 1922.

Very much less than fifty years ago—perhaps twenty years ago—there was a scandal in connection with the expenditure of public funds for certain harbor improvements in Savannah. But what would be thought of the logic or the sanity of a statesman who should now uprear himself in the halls of Congress and cite that Savannah episode as a cogent argument against the enactment ever thereafter of any and every bill for river and harbor improvements?

Subsidy Opponents Closely Identified with Foreign Steamship Companies

Yet the argument in the one case is worth just as much as it is in the other—and no more. It is an undeniable fact that most of the vociferous talking in America against subsidies to the American merchant marine has always been done by interests more or less closely identified with foreign steamship companies. Just now the lower part of the city of New York—the maritime district of New York—is infested by a great many individuals loudly protesting against any national aid to the American merchant marine—and it is a fact that almost invariably these individuals speak with a pronounced North European accent.

These gentry sometimes adopt other strange and reprehensible methods. The late Senator Gallinger of New Hampshire, than whom no more courteous or honorable gentleman ever lived, was accustomed to find in his mail from time to time letters, always anonymous, denouncing him for his leadership of the movement for American shipping—and all these brave missives bore the postmark of some station in the lower part of New York City, then dominated almost wholly by European steamship offices. Argument by vituperation has, significantly, always characterized both the foreign and domestic enemies of protection to American shipbuilding and navigation. The average anti-ship subsidy editorial alike in New York and on the other side of the Atlantic usually reads as if it were written in the spirit of the common scold.

But it will take something more than these characteristic methods of obstruction this time to check the victorious progress of the present aggressive national movement to bring our ocean shipping interest within the circle of American protected industries. Protection vigorously applied and adhered to has made the United States the greatest manufacturing nation in the world. It has the power—as our foreign rivals know full well—to make the United States the foremost ocean shipping nation.

Noted Mining Engineer Advocates Shipping Bill.—Prompted by many years' study of the subject both at home and abroad, John Hays Hammond, the eminent mining engineer, has wired to Chairman Lasker of the Shipping Board his appreciation of the efforts being made in the behalf of an American merchant marine. "It is regrettable," he said, "that our people do not fully realize the inter-dependence of every class of the community and every section of the Union and that an American merchant marine is indispensable for our export trade upon which the prosperity of all our industries depends."

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Ask Your Congressman to Support the Shipping Bill

Hearings Under Way—Endorsement of Congressional Committees Expected—Ultimate Victory Certain But Don't Stop Working Until the President Signs the Bill

By "Old Scotch"

As they say in racetrack parlance, "They're off!" The "they" in this instance doesn't refer to horses but to our solons in Washington. After much preliminary training and several false starts, the long promised hearings on the Administration's subsidy bill, the Magna Charta of American shipping, were begun on April 4.

An auspicious start has been made, inasmuch as the very unusual procedure was adopted, in the case of this measure, of holding joint hearings, that is, the members of the Senate Committee on Commerce and the House Committee on Merchant Marine and Fisheries sit around the same table, thus affording the witnesses the opportunity of addressing both committees at the same time. This will not only save the time of the Shipping Board experts, but it will reduce the time usually taken at hearings of like character by at least half. The chairmen of the respective committees, Senator Jones and Representative Greene, alternate in presiding over the joint committee.

A Bouquet for "Uncle Billy"

Speaking of "presiding," it is a cause of wonderment to see the able way in which that veteran statesman, "Uncle Billy" Greene as he is affectionately known to his colleagues, can wield the gavel and keep things going in a parliamentary manner. Mr. Greene has been in Congress nearly thirty years, and is now 82 years of age. During his long and honorable period of service in the national legislature he has devoted much of his time to problems of the merchant marine, and throughout his entire career has been the staunch friend and supporter of our merchant marine efforts. Both he and Senator Jones can always be relied upon to champion all legislation of a constructive nature, which comes to their committees.

At this writing, the discussion has progressed far enough to see that, barring unforeseen circumstances which may arise, there is a grim determination on the part of the proponents of the bill to give it the favorable endorsement of both committees. In all probability by the time this edition of Marine Engineering and Shipping Age is brought out the bill will be out of committee, and on the calendars of both houses, ready to be taken up for passage. Visitors at the White House have frequently stated in the public press that President Harding considers this measure the most important of all pending legislation, and is using every effort possible to secure favorable action.

Opposition From Our Foreign Rivals

While ultimate victory seems assured, we must "not fool ourselves," a term Chairman Lasker often uses in his testimony, that there will not be much opposition. Our rivals on the ocean are taking a very deep interest in the whole procedure, and view the whole proposition with alarm. Already certain European periodicals are printing lugubrious editorials of the terrible effect the passage of the bill will have on their own shipping, and even going so far as to threaten all kinds of reprisals. They are a very resourceful bunch, and we will have to be on the watch for the working of very subtle propaganda right in our own midst. Evidences of it are already apparent both in Congress and outside in the daily press.

The opposition thus far has centered among several southern congressmen, who are making things lively for the subsidy advocates who have thus far appeared as witnesses. They are no mean antagonists and, while no one doubts their patriotism, it is very hard to follow the reasoning of their antagonism. It is the opposition of other and more subtle influences, fostered by criticising journals, which is the most to be feared.

Facts are stubborn things to overcome and the advocates of the measure are loaded with many which cannot well be controverted. Much will depend upon how these facts are presented as to their ultimate effect on our legislators.

Circumstances Alter Cases

I think it was in an old copy-book that I first saw the maxim "Circumstances alter cases." In any event it is very applicable to the present discussion. While only two years ago, if any of us had even suggested that some of our best cargo vessels in the Government fleet would be offered for $30 a deadweight ton, he would have been thought crazy. Now, however, where freight rates have been cut to one-quarter of the terms then being offered in a teeming charter market, it is somewhat difficult for a ship that cost around $200 a ton to even make a living. The prevailing rate of $30 per ton hardly gives them a chance to compete with similar priced vessels of our rivals, in view not only of the greatly depressed rates but of the scarcity of goods that are moving over the ocean highways.

You can't sell snowshoes in July, nor linen dusters in January: no more can you sell ships when there is no demand for them. But just as surely as the seasons roll around, and make markets for snowshoes and linen dusters, will the conditions change and shipping once more be a going and a profitable business. It is for such conditions that we must make preparations, and the passage of the subsidy bill is the most vital of these necessary steps of preparedness.

Revival of Market for Ship Tonnage Predicted

The Chairman of the Shipping Board stated that, in his opinion, it would take 2½ years before they could dispose of any considerable amount of the Government tonnage, even if this bill passes. I am more optimistic than that, and will predict that with the gradual resumption of business activities now going on, and with the aid of this subsidy measure, there will be many ships disposed of in half that time. We must remember that with only one-third of the Government tonnage in use at the present time, we are carrying less than one-third of our outgoing and incoming ocean business. With the gradually increasing amount of goods to be carried, and the increase of the percentage carried in American bottoms, which must follow the passage of this legislation, there will be a very lively demand for ships.

In anything approaching normalcy in world conditions, Uncle Sam ships out of this country about 45,000,000 long tons of cargoes over salt water, and imports 35,000,000 tons over the same routes. That makes 80,000,000 tons of ocean freights to be carried. If we get only half of our own business, the amount we are aiming at for our own ships, we will have to utilize a great many more cargo vessels than we are now employing. Nor must we forget for a moment the

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$250,000,000 of freight money that we will keep in our own jeans.

Antagonism of Labor Pure "Bunk"

Much has already been heard about the antagonism of labor to the subsidy bill. Of all the "bunk" ever listened to which emanated from organized labor, this seems to be the limit. It is simply a question of having a job or no job for real Americans who depend on the sea for a living. It is stretching things very far to have to pick out the clause regarding the proposed naval reserve, with which to find fault. The language objected to is that officers and men who belong to the Merchant Marine Naval Reserve must "obligate themselves to serve in merchant vessels acting as naval auxiliaries in time of war or during the existence of a national emergency declared by the President."

The fear seems to be that "a national emergency" might be construed as a time of a general strike and that the naval reservists might be used as "strike-breakers." Aside from the facts that such a procedure never has been resorted to in this country, and that $3,000,000 per year, the limit fixed by the bill for naval reservists, would not go very far towards manning vessels, it would seem that this idea is the figment of perverted imagination on the part of some leaders.

Opposition Did Not Originate With Engineers

The rights of organized *American* labor on the seas should always be upheld, and, while there is not the shadow of a fact to hang such a suspicion on, as has been advanced, it is quite probable that the proponents of the subsidy bill will be perfectly willing to have the clause "or during the existence of a national emergency declared by the President," eliminated from the bill. To the credit of the engineers' associations, composed as they are entirely of American citizens, it may be stated that the opposition did not originate with them and that they realize in common with all other patriotic Americans that the subsidy bill is the one great effort which promises to give us the much desired merchant marine.

Merchant Marine Association Doing Effective Work

The National Merchant Marine Association, composed as it is of the leading shipowners, builders and operators, and many prominent exporters from all parts of the country, is accomplishing much good work in molding public sentiment in favor of the bill. The Charleston, S. C., Chamber of Commerce has gone on record in favor of the measure, as have also the New Orleans Chamber of Commerce, the Mississippi Valley Association and many other prominent business associations in the South and Middle West, largely through the efforts of the National Merchant Marine Association.

The association has sent out able public speakers, who appear before these commercial bodies and give very cogent reasons why the communities they represent are as greatly interested as are the people who live along the seacoasts. The Shipping Board itself, through the efforts of that splendidly equipped subsidy proponent, Commissioner Edward C. Plummer of Maine, has accomplished much in spreading facts before commercial organizations. Commissioner Plummer has made a lifelong study of this subject and there is no abler man in public life when it comes to discussing American shipping and its needs.

Taking it all together, my maritime brethren, there is no need of apprehension regarding ultimate victory, but do not let this deter you one iota from continuing every effort until the name Warren G. Harding is appended to the bill, thus making it the law of the land.

Gantry Traveling Crane at Seattle Pier

This crane, which covers a section of an open pier at Seattle known as Smiths' Cove Pier A, is of 225 horsepower, electrically driven and is lighted for night loading and operates over a distance of nearly 1,000 feet. It serves the depressed tracks in the center of the pier and also juts out 40 feet over the channel alongside so that cargo can be loaded direct from the car to ship and vice versa. This pier is used almost exclusively for general Oriental merchandise consisting of rice, beans, copra oil, hemp, matting, rubber, camphor and a great many other light commodities shipped from Japan, China and India. On this large pier the chief export cargo handled is steel, lumber, iron and machinery.

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Shipping Bill Hearings Develop Exhaustive Testimony

1,500,000 Gross Tons of Passenger, Refrigerator and Fast Cargo Ships Needed to Make Our Merchant Fleet Efficient

JOINT hearings of the Merchant Marine Act of 1922 before the Committee on Commerce of the Senate and the Committee on the Merchant Marine and Fisheries were started in a committee room at the Capitol on Tuesday, April 4, Senator Wesley L. Jones presiding. This shipping bill has the unusual distinction of having been prepared by the Shipping Board, one of whose functions is to advise Congress on such policies as will, in its opinion, aid in the development and establishment of an American merchant marine.

Through the co-operation of the board, assisted by eleven well known marine experts, the President was provided with an elaborate array of facts and findings relating to our merchant marine upon which his recent message to Congress was prepared. In addition to this, a tentative bill was drafted which received the unanimous endorsement of the President and the entire Shipping Board. It was introduced in both houses of Congress in practically identical terms on the same day that the President delivered his message and in order to eliminate procrastination and delay, the Senate and House committees on marine affairs agreed to give it a joint hearing.

In order to expedite the hearings it was decided to allow each witness the privilege of giving his testimony in his own way without interruption, during which the members of the Congressional committees could make notes of the points on which they desired to ask questions. As the bill contains constructive policies of direct and indirect aid covering numerous phases of shipping, ship operation and shipbuilding, the Shipping Board arranged to have its case presented through men who are experts and specialists in their particular line, after which those interested in the proposed legislation and those opposed to it would be given the opportunity to express their views.

Construction Requirements for a Balanced Fleet

"With a reasonable amount of efficiency, we will require approximately 7,500,000 *gross tons of ocean-going vessels to maintain adequate mail and passenger service, to carry the greater portion of our estimated foreign commerce in dry commodities and to maintain our present status in the bulk oil movement.*

"Such a fleet would be composed of approximately 3,600,000 *tons of slow cargo ships;* 1,250,000 *tons of fast cargo ships;* 750,000 *tons of combination liners;* 400,000 *tons of passenger ships and* 1,400,000 *tons of tankers. To achieve a balanced fleet then would involve the construction of* 1,500,000 *gross tons of the higher class freight and passenger ships, in addition to the replacement of old vessels."*

—R. T. Merrill.

Mr. Lasker Gives a General Analysis

"The matter under consideration," said Mr. Lasker, "is not merely one of subsidy or no subsidy; it involves what shall become of the Government's vast war-built merchant fleet; what shall be done to end the large losses of governmental operation of ships through the Emergency Fleet Corporation; what shall be done to insure the overseas carriage of America's surplus products in times of peace; and it involves, in importance possibly beyond all these questions, whether America, through the possession of an adequate merchant marine, shall be self-sustaining, and self-sufficient on the seas in times of war."

He pointed out that times had changed from the pre-war condition of a debtor nation which could be practically assured that the countries that we owed which were maritime nations would furnish us with ships to carry the goods to liquidate our debts to that of a creditor nation holding the first economic place in the world. History proves that no nation that is not strong on the seas was ever able to hold the place that we now occupy.

"We find ourselves today," declared Mr. Lasker, "with the Government owning 1,442 steel ships, aggregating 7,000,000 gross tons, operating 421 of these ships at an estimated cost to the Treasury for the comming year of $50,000,000 and with 1,021 ships tied up; we find private operations, as well, being conducted at startling losses due not only to depressed world conditions but to the impossibility of the private owner maintaining himself in the face of continued Government competition."

He explained that the purpose of Government operation, as defined by law, was to build up trade routes in order that the Government ships might thus be sold with established good will to private owners. The very method chosen has worked to defeat its own purpose, for, in the upbuilding of those routes, the Government has operated ships; and, in the operation of ships, has driven its potential customers largely off the seas. Thus, we come to conclusions —from which there can be no escape—that, since continued Government operation means finally the possible and likely elimination of private operation of American ships, a method must be devised whereby the Government shall end its operation and, at the same time, insure carriage of American goods under the American flag through private ownership as contemplated by the Jones Act.

"Europe owes us governmentally and privately some fifteen billions of dollars," he said. "To pay in gold is impossible; there is not that much gold in the world. The only way that Europe can pay will be in goods, either raw materials or manufactured or partly manufactured wares. In turn, we must find new markets not only to absorb the surplus products, which Europe formerly took from us, but to provide for the sale of many of the products which Europe shall send to us in settlement of her debt. These products, if in raw or partly manufactured state, will be brought to completed processes by American labor; but, if permitted to flood our own market and if we do not find a foreign sale for them, they will so depress the price of wares at home as to threaten the prosperity of all our workers.

Farmers Demanding Marine Developments

"These newer markets lie across the ocean: to the south in the Western Hemisphere; to the east, in China and Siberia. It is the very need of trade in these markets that is the inspiration of the policy of the open door in the Far East."

"The farmer," declared Mr. Lasker, "has but recently seen

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what it means to him in depression in price of his entire production when exports fail and the surplus of this production backs up at home. We have but lately seen how our Government's expenditure of $20,000,000 plus $12,000,000 from the Soviet Government, for grains to starving Russia, marked the beginning of an uprise in price of all our cereal products From the very time that these purchases began the price of wheat, corn and oats rose. It is not contended that these purchases alone were responsible for the uprise, but they were one of the several factors that resulted in the farmers' depression being alleviated.

"The farmers of our chief 18 agricultural States," he said, "with a total population of 40,000,000, are making a demand to which an affirmative response seems certain—that the ocean be brought nearer to them by the building of the St. Lawrence waterway, a conception that our Middle States will refuse to surrender until it becomes a reality. There can be no certainty of even a fair trial of that project after it is built unless we can have a profitable operation of American ships, because the carriage in that waterway is but seasonable, and other nations might not afford to work out a system of flexibility of tonnage for use in that waterway to our advantage. Assured flexibility for use of that project must come from us and from us alone. Therefore, when the farmer's dream of the St. Lawrence waterway comes true, as come true it will, it can have no assured life without an American merchant marine, and that merchant marine should be well established before the canal becomes a reality, that companies of sufficient strength may be alive to take advantage of its opening.

The Naval Auxiliary

"Having agreed to a naval program of 5-5-3 we can have no thought or hope of actual naval equality unless we can supply and bunker our Navy through our own merchant ships in time of war, should that unhappily come again. When President Roosevelt sent our Navy around the world, it had to be supplied and bunkered by foreign flag ships. Our naval jaunt showed the nations of the world its feet of clay. In 1914, when the world war began, be it said to the shame of America, she possessed but 15 passenger ships as to be of use for naval auxiliaries, while Great Britain possessed over 200 such ships. Today we possess 50 to Great Britain's 250. But when age and speed, which are the determining factors in the use of such ships for naval purposes, are considered, Great Britain's margin over us is further increased."

American Ships Making Poor Showing

"During December, foreign ships carried 76 percent of our overseas general cargoes," said Mr. Lasker, "and 24 percent was left to be carried in American ships. This 24 percent measured our success in competing against foreign nations for the carriage of our products to the markets of the world. Of the 24 percent, 19 percent was carried in Shipping Board vessels and 5 percent by private American owners.

"It must be the purpose and aim of America, and the Shipping Board emphasizes its belief that this aim can be accomplished, to carry at least 50 percent of our foreign trade, other than with contiguous countries and nearby countries under the American flag, privately operated. We are today carrying 87 percent of our oil trade with Mexico and 57 percent of our Caribbean trade in our own ships. But neither the needs of the trade with Mexico or the Caribbean call for that type of ship which is the very backbone of the second line of defense of our Navy, nor the type of ship which is the forerunner of world trade and world intercourse—the fast passenger and the combination passenger and cargo ship.

"There are many things necessary to successful ship operation in which the Government cannot engage. For instance, often it becomes necessary to buy and sell merchandise in order to insure cargoes. The most successful fleets under the American flag are those of the United Fruit Company, the United States Steel Corporation, the Bethlehem Steel Corporation and the Standard and other oil companies. The owners of these fleets are engaged in trading and thus insure full tonnage. No Government operation can do this. The Shipping Board at the present time is negotiating for the sale of several ships to a concern, which in turn is negotiating with the Chilean Government, whereby the American concern sells the Chilean Government 300,000 to 600,000 tons of coal a year for a term of years, during which time it takes 300,000 to 600,000 tons of nitrate in exchange. Thus those ships are assured of cargo through trading connections.

Government Aid Necessary

"Private ships under the American flag must be governmentally aided, because of the higher standards of living of American labor in the shipyard and on the ship. The men who build ships, work in America with a higher wage; the men who man our ships are paid more and sustained better than the foreigners. Who in America would have it different? Who in America would question that the prosperity of one should be the common prosperity of all and that these higher standards should prevail with all the people of our country? It is of prime importance, if we are to have an American merchant marine, that our merchant marine should consist of ships built by American workmen in American yards, because, if we are once again engaged in war, unless we control our own yards and our shipbuilding, we will be lacking in the means of instant and sure repair and renewal."

Statement of Mr. Daniel H. Cox

Mr. Cox, of the firm of Cox & Stevens, New York, prominent naval architects, pointed out that "it is obvious that the merchant marine of any country desirous of competing successfully with other countries in commerce on the high seas must be composed of ships which individually are equally as efficient as those ships of other nations engaged in the same trade." Particularly is this true of such a nation as the United States, he declared, "which labors under definite natural handicaps as compared with other nations already well entrenched in the carrying trade of the world.

"If to the unavoidable disadvantages, such as higher cost of construction with accompanying higher charges for interest on investment, depreciation and insurance, higher cost of wages and subsistence of officers and crew, lack of established connections in the various seaports of the world, and the nautral difficulty of securing business that for many years has been handled by other countries, be added to the handicap of ships not suited for the trade in which they are employed, the case is hopeless.

Government Aid Absolutely Essential

"With the experience I have had in this and other trades, I want to say that any man who claims that without a subsidy and without the kindly support of the Government he can build up permanently an American service of combination cargo and passenger ships, on competitive routes, and particularly on the Pacific, where they are most urgently needed for protective purposes, is either badly advised or, for reasons of his own, is making statements which are not so."—A. J. Frey, vice-president, in charge of operation, Emergency Fleet Corporation.

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"Only by the use of the most efficient type of ships can we, even with the most liberal form of Government assistance, render the regular and reliable service demanded, at the going rate, and hope to make the venture a profitable one."

Mr. Cox stated that from a general knowledge of the shipping situation, it is his belief that the American merchant marine is seriously lacking in ships of the following characteristics:

(1) Passenger and mail ships of 15,000 gross tons and up, with speeds of 18 knots and over.
(2) Passenger and cargo ships of 10,000 to 15,000 gross tons with speeds of 14 to 16 knots.
(3) Fast cargo ships of 9,000 deadweight tons and up, with speeds of 12 knots and over.
(4) Refrigerator ships of 8,000 to 12,000 gross tons, with speeds of 14 to 15 knots.
(5) Ships propelled by Diesel engines or Diesel electric drive.

HOMER L. FERGUSON TESTIFIES

Whether or not our legislators, now that there is no immediate danger of war, will be influenced by the importance of the merchant marine as a naval auxiliary, there is no doubt in the minds of thinking men that this is one of the most important reasons for developing our shipping. Mr. Ferguson said in part:

"As the number of war vessels is to be restricted, the importance of the merchant fleet as an auxiliary to the war fleet is correspondingly enhanced. Should war fleets be abolished altogether, the sea would be definitely in control of those powers having the largest and best equipped merchant fleets. Heretofore the American naval fleet had existed without a corresponding merchant fleet, which has generally been held as necessary to a strong Navy. Great Britain and the United States agree that their naval fleets should equal each other in strength; it does not, however, follow that their war strength on the sea will be equal, because that country having the best shipping inevitably would have a tremendous advantage. A merchant fleet is always a potential war fleet and forms, both in equipment and men, a naval reserve, whether called that or not. To neglect merchant shipping while limiting war shipping is deliberately to invite disaster. Many great issues have been decided by merchant shipping in the absence of suitable naval vessels. The British fleet of 197 vessels, of which only 34 were naval, destroyed the Spanish Armada, a blow from which the maritime power of Spain has never recovered.

"American shipbuilding up to the war had been built primarily on the demands of the Navy, and nearly all of the large shipyards had been developed mainly with the idea of satisfying those demands. While merchant shipbuilding has been important, the types and character of the merchant ships built in this country have not been at all in keeping with the best vessels built abroad, so that it has only been in our warship construction that we have kept pace with the shipbuilding art in regard to engineering features, size, power, speed and shipyard equipment both in men and tools.

"With large naval building definitely abandoned for at least 10 years, it stands to reason that the large, well-equipped shipyards must build large and powerful merchant ships, or the ability to produce, either for a merchant marine or a Navy, will become very much weakened and probably disappear. There is no engineering feat requiring more training and ability than the building of large, powerful vessels. If the number of large cruisers is limited or if they are abandoned altogether, armed merchant vessels will be quite as useful then as large cruisers are now in case of war."

PASSENGER SHIPS AND IMMIGRATION

A great deal has been printed about the ruinous freight rates that shipowners have been compelled to accept for the carriage of cargo but very little prominence has been given to the fact that passenger fares are still practically at their maximum. Passenger ships in the transatlantic trade that are modern and efficient are making good money. It is this type of vessels that are badly needed to balance our fleet and it is this type of vessels that capital could be most easily obtained for, if the Government sees fit to grant sufficient aid to equalize the difference in first cost and operation between American and foreign ships.

Mr. Rossbottom, general manager of the United States Lines, testified that "the foreign steamship organizations that have been operating steamship lines of foreign registry between Europe and the United States have expended millions of dollars in their respective countries for the construction of new steamships, and have paid large dividends to their stockholders as a result of engaging in a passenger and freight traffic that either originated in the United States or was destined to the United States.

"They have not found it very difficult to convince the citizens of their respective countries that when traveling to and from the United States on pleasure, or on business, they should patronize the steamship flying the flag of the country of which they are natives. This applies equally to English, French, German, Italian, Japanese, Norwegian and other European nationalities. Neither has it seemed difficult for these foreign steamship lines to induce American citizens, whether traveling officially or on pleasure or on business, to patronize steamships of foreign registry even in preference to steamships of American registry, and, as Americans form the large majority of travelers in the first and second cabins, we have seen the rapid development of the merchant marines of all foreign countries through money earned in this country.

"There is, however, one part of the passenger traffic to the United States that Congress can assist in diverting to steamships of American registry, and thereby furnish the nucleus of an earning capacity that will place American steamships in a better position than ever before to compete with foreign steamship lines for the traffic to the United States, and that is by favorably considering the suggestion that has been made, that not more than 50 percent of the alien passengers arriving in the United States shall be brought here in foreign vessels."

Time Opportune for Building Up Our Merchant Marine

"This is the time to start the upbuilding of our merchant marine. The foreign lines have been hit just as well as we have, and while they have not abandoned a single essential route or service that they covered prior to 1914, *they are reducing their tonnage in keeping with reduced revenue and volume of cargo moving. If we can establish our services, therefore, under existing conditions, we will surely prosper as these conditions improve, for it will give us an opportunity of proving to merchants that we are in the business to stay, and thus will gain their good will and their support when world trade improves. This, however, cannot be done unless the Government comes to the aid of the merchant marine for reasons previously set forth."*—W. J. Love, vice-president, Emergency Fleet Corporation.

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Developments in Marine Insurance

Liner Rates for Shipping Board Boats—"Leviathan's" Insurance—Floating Mines—Lake Navigation—Pilferage

By "Bordereaux"

IT has been a distinct achievement to secure such fine co-operation between marine underwriters and the Shipping Board authorities as to gain the significant concession of first class liner ratings for the best grade Board vessels. This places the latter on a parity with similar tonnage with which they have to compete in foreign carriage, and will attract a substantial volume of shipments to American vessels—thus greatly benefiting both shipper and shipowner. One authority has estimated that the saving in insurance cost to shippers will vary between five and twenty-five cents per hundred dollars carried.

In this department last month an account was given of the organization of a determined effort to work out a classification of Shipping Board vessels for insurance rating purposes, through committee conferences representative of the Board and of leading marine insurance interests. Sooner than could have been hoped for by the most sanguine have come the fine results alluded to above. They represent mutual concessions—a willingness on the underwriters' part to stretch a point wherever they could, and on that of the Board to correct the minor structural defects in their vessels objected to by the former. For an initial step in the proposed series of agreements it is a decidedly important one. The first class ratings are applicable to vessels of the Shipping Board under twenty years of age, as also the 535- and 522-foot types for both passenger and cargo service, and the former German liners now under the American flag in the Atlantic trade. They affect such lines as the Munson, United States, Admiral and Pacific Mail, operating to South American, Far Eastern and European points.

The classification conferees are now at work on Shipping Board vessels of the next grade of importance, and in order thoroughly to understand their capabilities in this respect the underwriters are studying their voyage accounts to learn of their behavior at sea, the ability of their officers and crews, their engine capacity, etc. These out of the way, the smaller freighters are to come up for consideration.

In the conferences to date the underwriters have been represented by Charles R. Page, Hendon Chubb and William H. McGee, and the Shipping Board by Vice-President William J. Love of the Emergency Fleet Corporation, Commander R. D. Gatewood and B. K. Ogden.

Insuring the Leviathan

WIDESPREAD commendation is very properly being accorded American underwriters for the admirable support they gave the Government in the insurance of the *Leviathan* on her run to the Newport News yards where she is to be reconditioned for service in the Atlantic passenger trade. The brokers whom the Government called in to handle the placing of the insurance are loud in praise of the fine spirit displayed by our underwriters in drawing the bow to its full American capacity. While it is true that our market was exhausted before half of the required coverage had been effected, and that as much more had to be placed elsewhere, the fact remains that American marine insurance did its best, and in so doing eclipsed any previous performance of the kind in this country. Incidentally, the "get together" spirit manifested demonstrated the effectiveness of the American Marine Insurance Syndicates; only one office outside of the syndicate membership participated in the insurance.

The eighty odd companies in the syndicates accepted $2,000,000 for the trip to Newport News at a rate of one-quarter percent and on a valuation of not less than $4,000,000. The other office took $200,000 additional. This left $2,000,000 to be placed abroad. On betterments at the yards, covering on labor and materials and certain incidental expense, a builder's risk insurance was taken out by the Government for a total of $6,551,000. This attached from the time the vessel reached the yards until the reconditioning has been finished—a period of between twelve and fourteen months, it is estimated. The Government assumes the risk on the vessel itself. Of this builder's risk coverage the syndicates accepted $2,500,000, and the balance was placed elsewhere. The valuation was fixed at not less than $4,000,000.

Floating Mines Still Being Found

IT may have been a considerable time since the late world war ended, but war risk insurance is still desirable. The Hydrographic Office of the Navy Department recently sent out a radio broadcast announcing that a floating mine had been sighted directly in the pathway charted for lines plying between Boston and Europe. The exact location was given as south of the Grand Banks and west of the junction at sea where vessels bound from Europe for Boston leave the track of the Europe-New York liners and bear almost due west. Since the first of last year eight floating mines have been located in the North Atlantic off the American coast, and two off our coast to the south.

Lake Navigation Opens

THERE is a general feeling of optimism among underwriters with respect to the outlook for a better season than last in insurance operations on the Great Lakes. Ice conditions were favorable in the neighborhood of the upper ports considerably earlier than the official date of the opening of navigation, which is April 15, and there was an occasional sailing around the first of the month. The former valuation of $70 per ton will probably prevail this season, and the rates will be little altered despite the complaint of the underwriters that they should be and that the margin of profit is always too near the vanishing point for comfort. It is anticipated that the strike of the coal miners will have the effect of eventually reducing the output of the mines that ship from the lower ports. This would mean that the freighters that carry full cargoes of ore from Lake Superior would have to return light, as coal is regularly their principal cargo on the voyages north.

A Significant Straw

THAT a revival of foreign trade and a consequent increase in ocean marine insurance operations is due in the near future is the significance attached to the entry into that field of the powerful group of companies composed of the North British and Mercantile, Pennsylvania Fire, Commonwealth of New York, and Mercantile of America. This

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important step has more than over-balanced the regret so generally expressed on account of the recent retirement of the Ætna Insurance Company from ocean marine. It is felt that such astute underwriters as those in control of the North British group would not have made this move had they not weighed every probability in advance and concluded that the worst is over and that better times for marine insurance are scheduled for an early appearance. Excellent judgment was also exercised in the selection of a marine insurance manager, their choice falling upon the veteran Albert Ullmann, who has been one of the most highly regarded underwriters in the New York market for the past twenty years.

Foreign Manager Appointed

STILL another indication of faith in our foreign trade campaign is conveyed by the action of the American Foreign Insurance Association in selecting John Ferguson, until recently manager of the Union Marine Insurance Company of Liverpool, as marine manager. Mr. Ferguson brings to his new and important duties an experience of twenty-six years as a marine insurance expert at Liverpool, Manchester and New York. He has been in command of a group of 250 agencies throughout the world, as their supervisor, and is eminently equipped to handle the many intricate problems involved in securing to American underwriters their proper share of coverage on world trade. As rapidly as circumstances justify it he will establish general headquarters in the various countries and through them sub-agencies at numerous important local points. There is general satisfaction in the selection of so capable a manager, and underwriters are looking forward to an increased revenue from remote geographical areas in consequence of the steady expansion of the American Foreign Insurance Association.

Favor Use of Spuyten Duyvil

UNDERWRITERS on inland marine risks are urging the adoption of the proposed plan of purchasing sufficient property at Spuyten Duyvil to enable the Harlem River to be widened and deepened so as to permit modern canal barges destined from North River points to East River points to make the trip through the river instead of proceeding as at present around the Battery, a distance of some twenty-eight miles.

Organized Pilferage

REPORTS from authoritative sources continue to accumulate evidence in substantiation of the belief that pilferage on the North Atlantic has reached a stage of scientific organization. It is now next to impossible to determine whether these depredations have occurred on board ship or not, and this is a matter of the utmost moment to the shipowner. Substitution of worthless junk for the original contents of the cases has reached a degree of perfection that elicits something akin to admiration. Most of it is believed to be done on trains or on lighters, and it is being urged that more extensive use be made of the numerous effective safety devices that have recently been introduced for the greater security of packing.

Collision a Marine Risk

JUDGE HOUGH recently decided, in the United States District Court, Southern District of New York, that a collision between vessels sailing in convoy and without lights was the consequence of a marine, not a war, risk. The court refused to consider the nature of the cargo as relevant, insisting that it was the nature of the operation which was the determining question. Negligence on the part of the navigators was maintained as the proximate cause of the collision. The underwriters were held liable for the loss. Such a court decision may come in handy in event of outstanding war risk claims coming up for settlement by shipowners.

Freight Claims

IT is frequently asked whether claims may be successfully pressed on account of freight which has been unearned by reason of the loss of a vessel, or for non-delivery or short delivery of merchandise. No accurate general answer can be given, but it is suggested that when the freight unearned can be accurately computed the amount thereof be added to the bill against the carrier. It may or may not be honored. There is usually a provision inserted in the contract of affreightment whereby the freight accrues to the shipowner's vessel "lost or not lost." It might be possible, if the amount involved were sufficiently large to justify suit, to collect the amount of freight that has been paid but unearned because of failure to deliver the merchandise. In the main, however, it is too small a matter to take much bother over.

Oil in Harbor Waters

INDISPUTABLY there is much room for improvement as regards the pollution of harbor waters through the discharge of waste and fuel oil, but even so, matters are on the mend. The National Fire Protection Association recently came out with a circular calling attention to unsatisfactory conditions in this respect at certain locations, notably Beard's Erie Basin, Atlantic Basin and the mouth of the Gowanus Canal, Brooklyn. It finds a general slight improvement of late and accounts for it on account of the co-operation of the shipping industry, which the Supervisor of New York Harbor has secured by the formation of a special committee. The activity of the United States Attorney's office in connection with specific violations of the law is also believed to have helped the situation. Better facilities are gradually being afforded for the removal of oil from ships, making it more convenient to dispose of it than to throw it on the water. National legislation, intended to improve conditions not only with respect to New York and other harbors, but also in behalf of the preservation of fish and bird life, as well as the beach resorts, is before Congress.

Inferior Ships

CHEAP freight rates are attracting shipments from South America to the United States in steamers of decidedly inferior class, not to mention lighters in tow, and sailing ships. This is giving the underwriters considerable concern. They cannot understand why merchants should be willing to take such serious chances with their cargoes, particularly as there is no occasion for so doing in view of the repletion of idle but standard steamers. A large amount of sail tonnage is now being operated in the North Atlantic and West Indies trade, and wool cargoes are going under sail from London to so remote a point as Australia. It should be borne in mind that many underwriters do not insure sailing ships at all, and merchants employing that form of transportation are likely to find themselves embarrassed when it comes to effecting coverage under open or closed policies. It is much better all around to make use of safe bottoms.

No German Insurers Coming

ABOUT so often a rumor gets whispered around to the effect that German underwriters are planning to resume operations in the United States. There is nothing to it. Financially it would be impossible for German unadmitted marine writing companies to establish them-

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selves here; the low rating of the mark on exchange would effectually dispose of any such undertaking. The Germans themselves are without information as to a probable date of release of funds of German companies that were operating in New York prior to the war and whose American resources now rest with the alien property custodian. Congress will have to settle that. Liquidation of claims against German companies on policies in force before our Government seized the branch offices has been completed, but the remaining assets have not been released and nobody knows when they will be.

Some London Recommendations

IN the interesting report of the Committee of the Council of the British Chamber of Shipping, recently published, an almost despairing review is made of the wholesale amount of pilferage still being carried on in all parts of the world. The committee conducted a world-wide investigation of the subject in order to try and arrive at adequate remedial measures. It found a general paucity of police protection and severely arraigned the carriers for alleged laxness in safeguarding shipments while on docks and during actual loading through failing to provide adequate watchmen service and by failing to insist upon the arrest of dockhands suspected of stealing. Among the recommendations made by the committee were the following: Tallies should be taken both in and out of ship, and extended use should be made of the alphabetical system by those tallying on behalf of the ship, as it prevents collusion with those using continuous sheets tallying against the ship; there should be only one entrance to cargo holds (down the hatchway); all ventilators should be protected to prevent access to holds through them; shipowners should prosecute every detected case of pilferage; magistrates should be urged to impose imprisonment on persons convicted, as fines are inadequate; customs officials should mark with an official stamp or seal all cases or casks from which samples have been extracted; and shipowners should revise their standing instructions to masters and officers in reference to the care and handling of cargo, to bring them up to date.

Maritime Nations Propose International Regulation of Deck Loads

THE proposal of foreign maritime powers for the limitation or total prohibition of deck cargoes, and the establishment of an international load line, is of the greatest importance to American shipping.

According to dispatches received from Geneva, Switzerland, by Ernest Greenwood, American correspondent of the International Labor Office, representatives of foreign governments, shipowners and seamen on the Joint Maritime Commission of the International Labor Organization, are in unanimous agreement as to the need of international action in the matter. Whether this action will take the form of regulations based on the present British rules, as is desired by the seamen, or whether modified regulations will be adopted, as the shipowners prefer, remains to be settled. It is said that a radical divergence of opinion also exists among the delegates as to whether regulations should authorize specific rules restricting the height and weight of deck cargoes, or whether they should permit the certification of vessels as fit for the carriage of deck cargoes, according to type, and with or without a special load line.

It is contended by the seamen's organizations that many lives have been lost and many men injured at sea each year by the carriage of deck cargoes. It is the hope of the seamen to have the British regulations used as a basis in the adoption of international regulations. On the other hand the opinion seems to prevail among shipowners and shippers that the British regulations are too stringent and that elasticity might usefully be introduced into the rules. The shippers point out certain anomalies arising out of the strict application of the British rules, and mention two specific cases, one the case of a turret-deck ship; the second case was that of a ship being penalized at Hamburg for being insufficiently loaded, owing to her having rejected a deck cargo in America, because of the penalties she would incur in Great Britain for overloading.

This is the first time the question has been discussed by both shipowners and seamen. It has long been a matter for discussion among shipowners, conferences having been held at Paris in May, 1921; at Madrid in October, 1913, and at the Hague in August, 1921. The seamen themselves have gone into the matter at meetings at Washington and Antwerp.

The present joint conference is made possible by the establishment of the Joint Maritime Commission by the International Labor Organization, an autonomous association of 54 nations established under the Peace Treaty of Versailles. The present negotiations involve Belgium, Japan, Great Britain, Sweden, Canada, France, Italy, Norway and Germany, these countries being represented on this commission.

Steam Versus Diesel Drive

By J. E. P. Grant*

FOR long voyages there is no doubt but what the Diesel engine has arrived and will do more than any other single factor to reduce the cost of operation.

The selection between steam and Diesel drive depends almost entirely on the respective initial costs of these installations. Diesel engine prices in the United States are very high yet, and this, of course, decreases the range of desirability of this type of engine.

Where to draw the line between steam and Diesel drive requires special study of the particular trade in view, but generally speaking, I would say that for powers up to 4,500 indicated horsepower and for voyages of four thousand miles and over, the Diesel engine is preferable, and that for powers above that mentioned and below the four thousand miles, steam should be selected. The minimum distance of voyage mentioned above will decrease as the costs of Diesel engines come down.

New Southern Pacific Oakland Piers

By Charles W. Geiger

THE Southern Pacific Railroad has recently completed at the Oakland, Cal., mole three new piers with berthing capacity for twenty-four vessels. More of these piers can be constructed as needed. The new piers are located on the south side of the mole. The present facilities consist of three units, or piers, which are located at an angle with the bulkhead line and are respectively 100 feet, 70 feet and 75 feet wide and each 875 feet long. On pier No. 1 is located a warehouse 80 by 380 feet in size with a floor space of 30,000 square feet. The trestles are full-span so that there are no posts to interfere with the handling of loads in the warehouse. This shed is served by two tracks down the center so that cargoes may be wheeled directly from slings to cars. The entire side is made of sliding doors so that any portion can be reached conveniently. Night loading is facilitated by excellent lighting arrangement.

Fifty vessels a month, carrying lumber, are unloaded at these piers. Trucks are so arranged on the lumber piers that transfer may be made direct from boat to cars. The facility with which lumber may be handled here is illustrated by the fact that one boat unloaded 155,000 feet of lumber in two hours.

*Chief engineer, Merchant Shipbuilding Corporation, Chester, Pa.

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Shipping and Shipbuilding in Great Britain

Cargo Boat Owners in Financial Difficulties—Liner Companies Appeal for More Capital—Shipbuilding Situation Chaotic

By W. H. Wendon

THE effects of the great depression in the shipping trade of the world are becoming increasingly evident in the financial affairs of British shipowning companies, notably in South Wales, where "mushroom" owners were to the fore in promoting companies during the late boom. The balance-sheets of some of these cargo boat companies covering the past year's working are now available, and it is the exception to the rule for a satisfactory result to be shown.

Failure of Cargo Boat Companies

The latest concern to announce its inability to continue trading is the Turner Steam Navigation Company, Ltd., which was formed early in 1920, with a nominal capital of £100,000, of which about £40,000 has been subscribed. The directors contribute the failure of the company to "the serious depression in shipping values, which set in a few months after this company was formed," and add that it has been found impossible to meet the heavy obligations of the company and carry on the business profitably. No less than £30,000 is due to mortgagees on the company's solitary steamer *Torquay*, of 1,054 tons deadweight, built in 1914. The mortgagees have served formal notice calling in the money forthwith. The vessel cost the company the appreciable sum of £74,000 in March, 1920, when the company was originally formed by its then promoters, but her market value at the present time is estimated to be between £15,000 and £16,000. There appears, therefore, no other course to adopt but to voluntarily wind up the company, and the necessary resolutions to effect this policy will be submitted to the shareholders.

The Bristol Channel Steamers, Ltd., is another Cardiff cargo boat concern which finds itself in difficulties. The depreciation in shipping values has impelled the directors of this company to counsel the reduction of the capital by fifty percent, representing approximately the present day value of the assets. This company provides one of the instances where, a large portion of the purchase price of the vessels not being borrowed on mortgage, the company can continue running, at all events for the time being.

The Heath Shipping Company, owning the small steamer *Deloraine*, sustained a loss of £668 on its past year's working. Added to the debit balance of £248 brought into the account, there is a total loss in the past two years of £916. The share capital issued amounts to £13,674, and there is an overdraft at the bank of £10,026. The company's steamer and leasehold buildings cost £22,250. Comment is needless.

Largest Cargo Boat Owners Fail to Declare Dividends

The St. Just Steamship Company, probably the largest purely cargo boat company in this country now that the ill-fated Western Counties Company is no more, is also experiencing troublous times, although not to the same extent as others. Partially owing to the slump, and to some extent to the fact that the company's taxation indebtedness has not yet been fully defined, the directors are refraining from recommending the customary dividend. The magnitude of the activities of this company, which is an amalgamation of single ship companies, will be gaged from the fact that it owns 21 steamers aggregating more than 180,000 tons carrying capacity, and standing in the company's books, together with investments, at two and three quarter millions sterling. It has, indeed, more money invested in shipping than any other cargo boat company in the kingdom. For the fifteen months ending June 30 last a dividend of 6¼ percent, free of tax, was paid, as against 7½ percent in 1919-20, 17½ percent in 1918-19, 10 percent in 1917-18, 20 percent in 1916-17 and 21 percent in 1915-16. It has a capital exceeding £2,000,000.

Turning from cargo boats to liners, the position regarding companies owning this type of vessel is rather more obscure. On the surface the companies are not doing badly; but appearances are sometimes deceptive. There is no disguising the fact that at all events some of the companies are in an unfortunate position following on the slump in values, for many of them have disbursed gigantic sums in acquiring boats at top prices to replace vessels lost during the war.

Liner Owners Ask for More Capital

Appeals for further capital continue to be a feature in the liner trade. Since the beginning of 1921 these appeals have aggregated no less than £14,500,000, and there are more to come. The Cunard Company initiated the movement in January last year, when it applied for, and obtained with consummate ease, £4,000,000. Then followed the African Steamship Company, the Clan Line of Steamers and the Union-Castle Line, and finally we have the P. and O. Company securing a further £3,500,000 and Messrs. Lamport and Holt £2,000,000.

In the case of the P. and O. issue, the money, according to the prospectus, is to be applied "more especially to the construction of new vessels when prices come down to an economic figure to replace those destroyed by enemy action during the war, and to build others to meet the growing requirements of the company's business." But it is significant that, in the case of the other companies, the money will be expended in meeting the payments on steamers already built at top prices, or which have been contracted for on a similarly ruinous basis.

Prospects for the Future in Shipping

Opinions differ as to the stability of the industry and the prospects for the future, but at least one shipowner, Sir William Noble, Bart., whose authority to speak on matters maritime cannot be questioned, is not disposed to indulge in pessimism. He goes so far as to say that the shipping industry is now approaching convalescence, if, indeed, it is not wholly on the road to recovery. He prescribes a sane and reasonable optimism as one of the best aids to this recovery, and expresses the view that a cynical pessimism can only prolong the period of distress. He points to the fact that in other countries the condition of the industry has been just as bad, if not worse, and deprecates the use of what he terms "quack remedies." He pleads guilty to being an incorrigible optimist and declares his admiration for the pessimist who has the courage, when the soup kitchens are open, to order half-a-dozen steamers. For his own part he prefers the philosophy of the typical Irishman, who, when difficulties confronted him, said: "Let me look back into the future."

According to the latest statistics, there are more than 2,000,000 tons of British and foreign shipping at present laid up in the 36 principal ports of the United Kingdom, a figure which compares with one and a half million tons in January last year. Of the two million tons referred to,

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no less than 1,900,000 tons fly the British flag. The subjoined table gives particulars of unemployed seagoing ships laid up in these 36 United Kingdom ports since the beginning of 1921:

1921	British No.	British Gross tons	Foreign No.	Foreign Gross tons	Totals Gross tons
January ...	...	.....	...	.....	1,505,000
April	...	.....	...	.....	2,732,000
July 25.....	883	2,641,000	140	323,000	2,964,000
October 25.	654	1,853,000	88	221,000	2,074,000
1922					
January 1..	621	1,887,000	91	205,000	2,092,000

Taking the smaller ports into consideration, it is calculated that at present there are vessels representing two and a quarter million tons laid up in the ports of the United Kingdom. With regard to British tonnage only, no account has been taken in these figures of ships lying in foreign ports. Careful computation places the total figures of unemployed British ships at 2,250,000 tons, out of a gross tonnage of over 18,000,000 tons, or 12½ percent. High as this proportion is, the figure does not compare unfavorably with foreign countries.

Regulations for Carriage of Wood Deck Cargoes

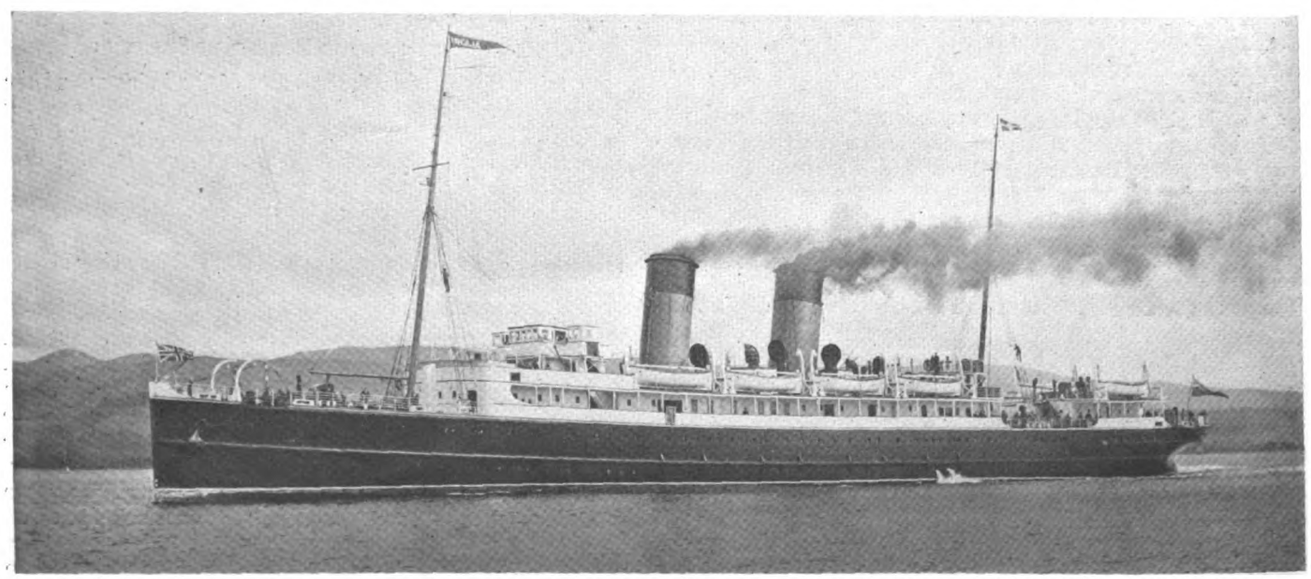
The important question of the regulations regarding the carriage of wood deck cargoes, which have been the subject of considerable discussion during the last ten years by various sections of the interests concerned, has reached a still more interesting stage. The Chamber of Shipping of the United Kingdom has addressed a communication to the Board of Trade, setting forth the views of the International Deck Cargoes Committee, which was one of the committees appointed by the International Shipping Conference held in London last November. In submitting the proposed regulations for the consideration of the Board of Trade, the Chamber of Shipping draws attention to the different practices of various countries in the definition of "winter seasons in Northern Europe and in the Northern Atlantic," which, as is pointed out, for the ordinary cargo freeboard regulations, are different from the present British regulations regarding the carriage of wood deck cargoes. The Chamber considers that the Governments of various countries should take common action to define the winter season, not only for the North Atlantic, but also for other regions of the globe, so that as far as possible fair treatment may be given for the seasonal variations of freeboard which all systems of rules take into account. The Chamber observes that this is the first time that it has been possible to secure unanimous agreement as to such technical regulations among all the countries in Northern Europe primarily concerned in the carriage of deck cargoes, and that the acceptance of rules of this nature will not only facilitate the free intercourse of merchant ships of all nationalities, but will appreciably reduce the cost of transportation of light wood timber to the British Isles—an important point in the general economy of the country.

The committee recommends that:

(1) All ships should have a certificate of fitness where the deck cargo exceeds 5 percent of the ordinary deadweight capacity;
(2) The various maritime States should agree on a uniform system of issuing such certificates;
(3) International expert opinion should be asked to decide whether, in addition to the above requirement, a uniform system of fixing a special load line and regulations restricting height and weight of deck cargoes would be desirable.

Shipbuilding Hard Hit by Taxation and Wages

The situation in the shipbuilding and engineering industries is by no means an encouraging one. Labor disputes on wages and the exercise of managerial functions have brought the trades to something amounting to chaos. Added to this, such few orders as are being given out are finding their way abroad, whereas in the normal sequence of events they would undoubtedly be booked up by firms in this country. A Hartlepool firm which tendered for five passenger ships for a Mexican navigation company is advised by the shipping company that England is not at present in a position to compete in shipbuilding with France, Italy or Germany. The lowest British tender was £99,000 per ship, whereas the price quoted abroad, apart from German builders, was as low as £47,000. Sir Alexander Kennedy, managing director of the Fairfield Shipbuilding and Engineering Company, Ltd., of Glasgow, holds the view that the breath of the shipbuilding trade is being crushed out by taxation and wages. In England and Scotland fifty percent of the shipbuilding berths are empty, and fifteen percent are occupied by vessels either canceled or on which work has been suspended. Moreover, despite the fact that shipbuilders are willing to sacrifice all profit, no new orders are forthcoming. In one English district with thirty-five berths, only two vessels are building, and twelve thousand men are idle.



Channel Steamer Anglia

One of Four 25-Knot Luxuriously Fitted Vessels Built by Messrs. Wm. Denny & Brothers, Dumbarton, for the Holyhead-Dublin Service of the London & North-Western Railway Company. The Vessel is 395 Feet Long Overall, 45 Feet molded Beam and is Certified to Carry 1,522 Passengers. Propulsion is by Twin Screw Geared Parsons Turbines Supplied with Steam From Nine Babcock & Wilcox Watertube Boilers.

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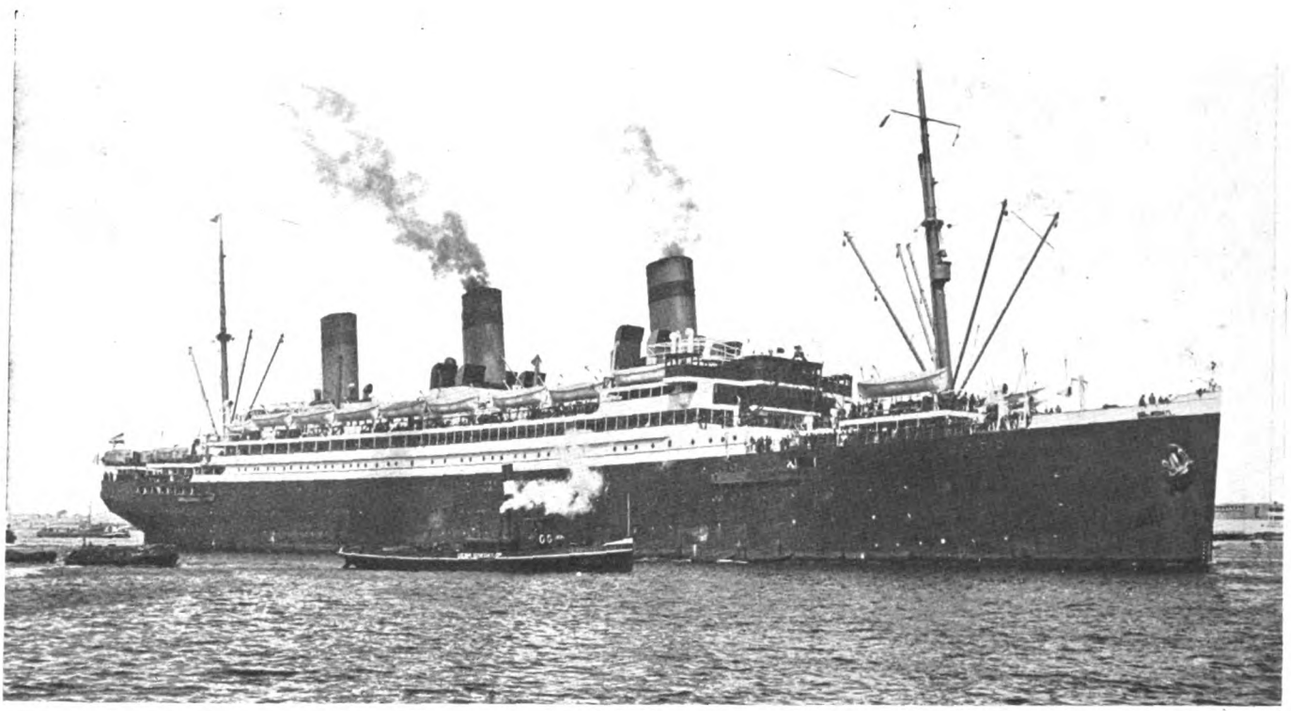

Triple Screw Liner Reliance, Sister Ship of the Resolute, Latest Additions to United American Lines' Fleet for New York-Hamburg Service

Passenger Liners Resolute and Reliance

Two 20,000-Ton Steamers Commissioned by the United American Lines for Their New York-Hamburg Service

WITH the arrival in New York on April 23 of the 20,000-ton oil burning, triple screw, passenger steamer *Resolute* a new fortnightly service between New York and Hamburg, with calls at English and French channel ports, was inaugurated by the United American Lines, the operating company of the American Ship and Commerce Corporation. This service will be maintained by the *Resolute* and a sister ship, the *Reliance*. On the eastward voyage the vessels will call at Plymouth and Boulogne and on the westward voyage at Southampton and Cherbourg. The time of passage to England and France will be about 8 days and to Hamburg about 9 days.

The entry into the North Atlantic service of these two luxuriously appointed passenger liners marks an important event in the history of the American merchant marine, as the *Resolute* and *Reliance* are the largest *privately owned* passenger vessels flying the American flag. These ships were originally designed for the South American service of the Hamburg-American Line. Both were laid down in Germany in 1914, the *Resolute* at the yards of the Actien Gesellshaft Weser at Bremen and the *Reliance* at the yards of John Tecklenborg, Bremerhaven-Geestemunde, but neither was finished until after the war in 1920 when they were sold to the Royal Holland Lloyd Line. In this service they ran for a year from Amsterdam to Buenos Aires via Boulogne, Plymouth, Vigo, Lisbon, Las Palmas, Rio, Santos and Montevideo, a voyage of 6,642 miles each way.

With the transfer of these vessels to American registry W. A. Harriman, chairman of the United American Lines, selected for them the names of two of the famous American yachts which successfully defended the *America's* cup against foreign challengers. By so doing he sought to commemorate in two of the finest ships flying the American flag in the competition of commerce the achievements of two contenders which so valiantly carried the American flag in the competition of sport.

Principal Dimensions of the Resolute

Although built in different yards in Germany, the two vessels are practically duplicates. The main particulars of the *Resolute* are as follows:

Length overall	618 feet
Length between perpendiculars	588 feet
Beam	72 feet
Depth to shelter deck	43 feet 9 inches
Draft, loaded	28 feet ¼ inch
Displacement, light	16,000 tons
Displacement, loaded	23,080 tons
Deadweight tonnage	7,080 tons
Weight of fuel oil	3,300 tons
Weight of fresh water	1,500 tons
Tons per inch of immersion	78
Horsepower	15,000
Speed	16¾ knots
Number first class passengers	364
Number second class passengers	276
Number third class passengers	467
Total number of passengers	1,107

Classed at the highest rating of Germanischer Lloyds the *Resolute* and *Reliance* are of the most modern type of construction and arrangement and no expense has been spared to make the vessels conform in appointments and equipment to the highest standards in passenger travel. The hull is subdivided by a double bottom extending from the forward

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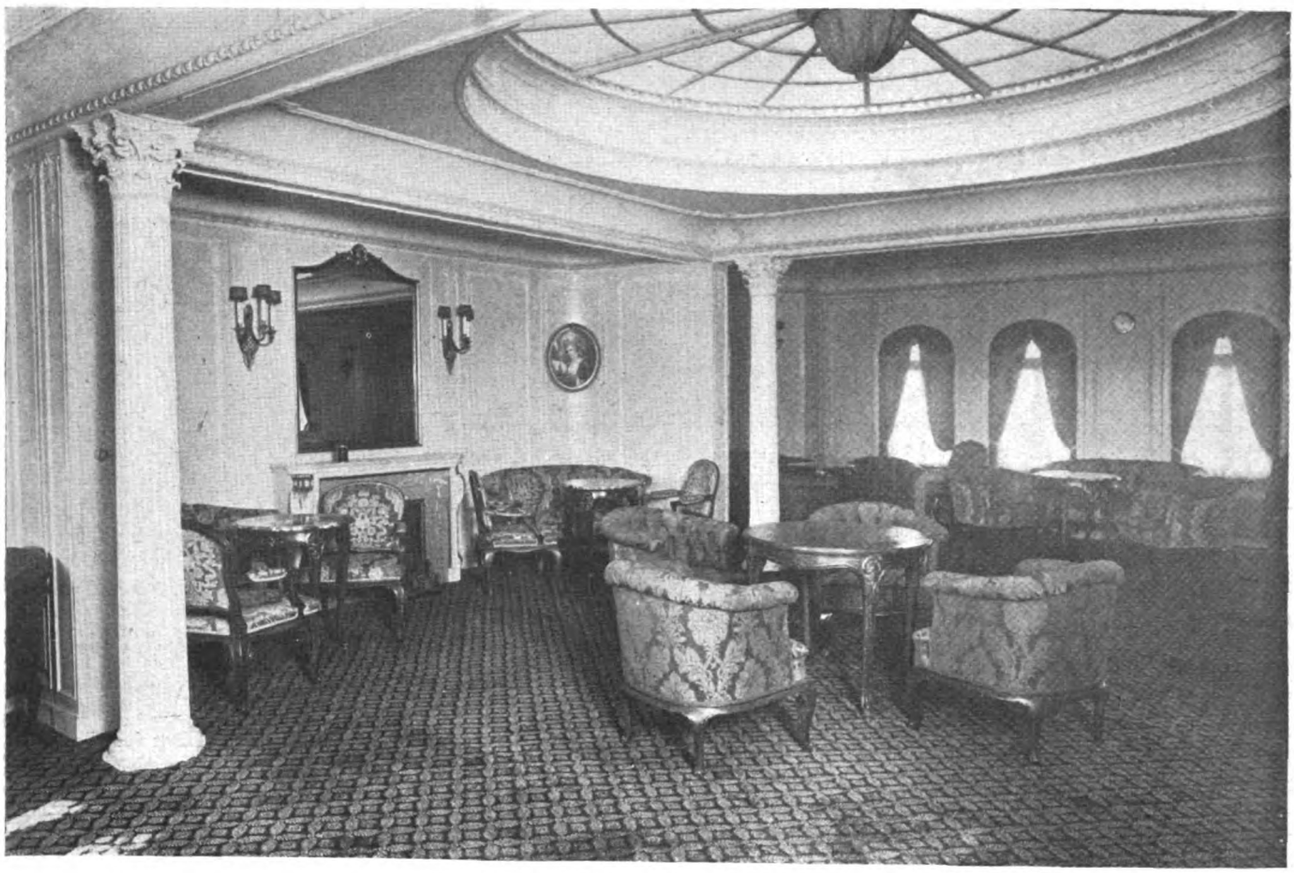
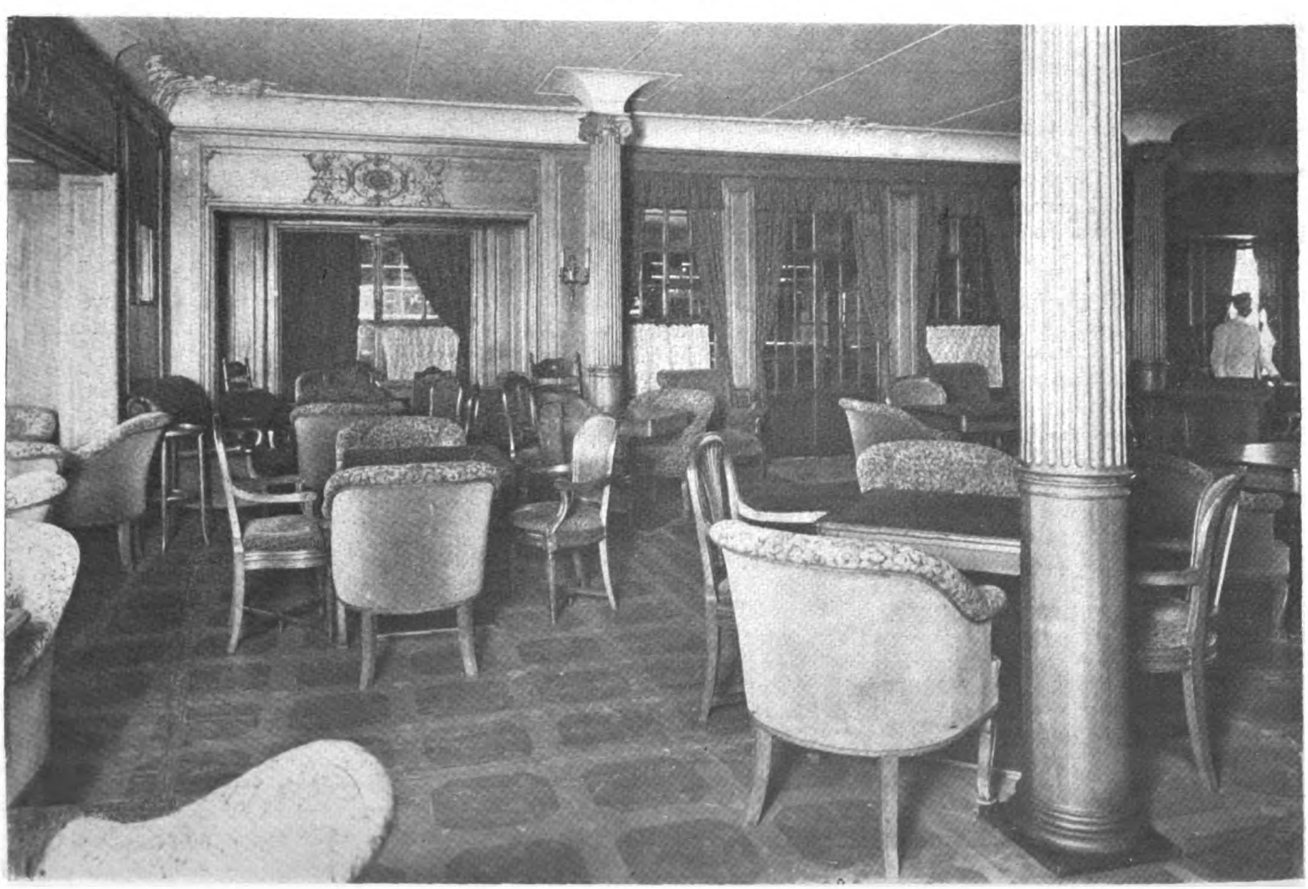


S. S. Resolute—Ladies' Saloon



S. S. Resolute—Smoking Room

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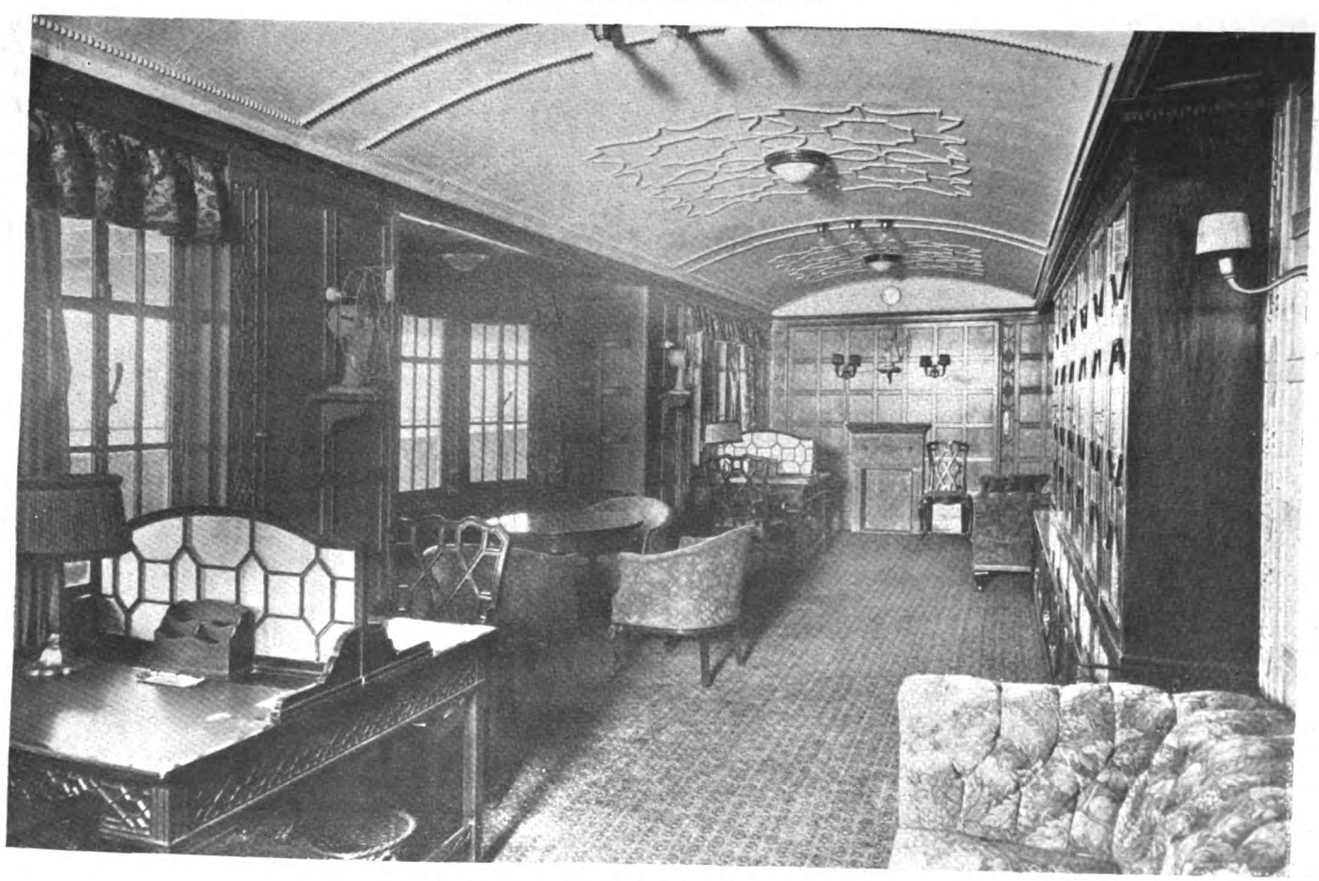
S. S. Reliance—Winter Garden



S. S. Reliance—Library and Writing Room

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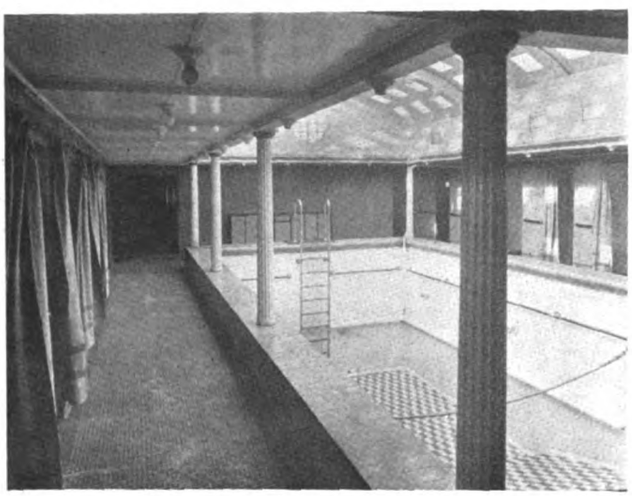
to the after collision bulkheads and by ten transverse watertight bulkheads carried up to the shelter deck. Above the hold and orlop decks there are in all seven decks, designated from the top, as A (Boat), B (Promenade), C (Bridge), D, E, F and G decks. All first class accommodations are amidships on A to E decks, inclusive, the second class accommodations aft on C to F decks, inclusive, and the third class accommodations forward on D to G decks, inclusive.

Propelling Machinery

Propulsion is by triple screws, the wing screws being driven at 80 revolutions per minute by four-cylinder triple expansion reciprocating engines with cylinders 29.5 inches, 49.2 inches and (two) 53.1 inches diameter by 59.05 inches stroke and the center screw at 210 revolutions per minute by a Parsons low pressure turbine taking steam from the low pressure cylinders of the reciprocating engines at 15 pounds per square inch. Seventy-one men are required for the engine room crew.

Steam is supplied to the high pressure engines on the wing screws at 240 pounds per square inch pressure by fourteen oil-fired Yarrow watertube boilers operating under Howden's system of forced draft, without superheat. The forced draft fans are operated by reciprocating engines. Each boiler has



S. S. Resolute—Swimming Pool

3,200 square feet of heating surface and 61.2 square feet of grate area and is equipped with three Vulcan burners.

The boilers are located in two boiler rooms separated by a fuel bunker having a capacity of 710 tons of oil. The total amount of fuel oil carried is 3,300 tons and the average consumption 165 tons per day. The uptakes from the boilers in the forward boiler room lead to the forward smokestack and those from the after boiler room to the center stack. The after stack, which is over the engine room is used for ventilation, exhaust from the galleys, etc.

The auxiliaries, all of which were supplied by the Vulcan Works, at Stettin, Germany, include four 115-kilowatt turbo generators, four 30-ton evaporators and two refrigerating machines.

First Class Accommodations

Accommodations for the 364 first class passengers are provided amidships extending over five decks.

On the boat deck, besides the fine open promenade space afforded, there are offered special inducements for recreation and sports in the form of an elaborately equipped swimming pool and gymnasium. The swimming pool itself measures 30 by 12½ feet and is surrounded by dressing rooms, shower baths, electric light baths and other equipment essential to its use. Aft of this is the gymnasium, fully equipped under the Zander system, alongside of which is a botanical garden and a photographers' dark room. Amidships on the boat deck is the wireless telegraph room and forward are the officers' quarters.

Except for a few special staterooms the entire promenade deck is given over to the first class public rooms and promenade. As shown by the illustrations these rooms provide all the comfort and luxury found in the best hotels on shore. In decoration, appointment and equipment they are designed to satisfy the most discriminating traveling public. The promenade space itself is 20 feet wide and extends clear around the ship with a length of 320 feet on each side. The forward part is protected against stormy weather by sliding windows.

Occupying a large space forward on the promenade deck is the winter garden. Arched by a dome of colored glass and sumptuously furnished this is used as the assembly room for dances, concerts and other entertainments. Further aft on this deck is the ladies' saloon, lighted from above by a glass dome and from the sides by broad groups of windows. Opening from the ladies' saloon on the starboard side is a spacious library and writing room which, with its arched and beautifully decorated ceiling, has an atmosphere of unusual distinction. The walls are paneled and along the inboard side are large bookcases containing the ship's library while opposite in front of the windows are writing tables.

At the after end of the promenade deck is the smoking room, paneled in mahogany, and just outside this the terrace cafe or promenade deck lounge.

The bridge deck amidships is given over entirely to first class staterooms except for the main lobby in the center containing the main office, purser's and chief steward's offices and the barber shop and ladies hairdressing parlor.

On D deck amidships is the main dining room extending the full width of the ship and in the center rising through two decks to a height of 16 feet. At the forward end of the room at the level of the bridge deck is a balcony for the orchestra. The color scheme for the dining room is pearl grey and lighting is accomplished by concealed incandescent lamps. The galley and pantry are below on E deck.

Aft of the entrance to the main dining room on the starboard side is a children's room decorated with paintings of characters familiar to readers of fairy tales and furnished with specially constructed low tables and chairs. The remainder of D deck amidships is given over to first class staterooms as is also a similar section of E deck.

The staterooms are large and well ventilated. In the first cabin bedsteads take the place of berths. Many rooms contain dressing tables, desks and chairs, in addition to the usual wardrobes and sofas. A large number of rooms are arranged for one passenger. Each room is supplied with running hot and cold water.

The private suites are provided with sitting rooms, baths and trunk rooms. When so desired meals are served in the suites.

Second and Third Class Accommodations

For second class passengers, whose quarters are aft, promenade space is provided on the promenade and bridge decks. The second class public rooms are on the bridge deck and include a large, pleasingly appointed dining room, a handsomely furnished social hall or lounge, a smoking room and ladies' parlor.

The staterooms differ from those in the first class accommodations mainly in that they have berths instead of bedsteads, but the fittings are up to date in every particular. Many of the rooms accommodate two passengers only.

The third class quarters, located forward, have been transformed from open berths to rooms for two and four passengers. Dining rooms, a ladies' parlor and a smoking room are provided and promenade space is available on C deck.

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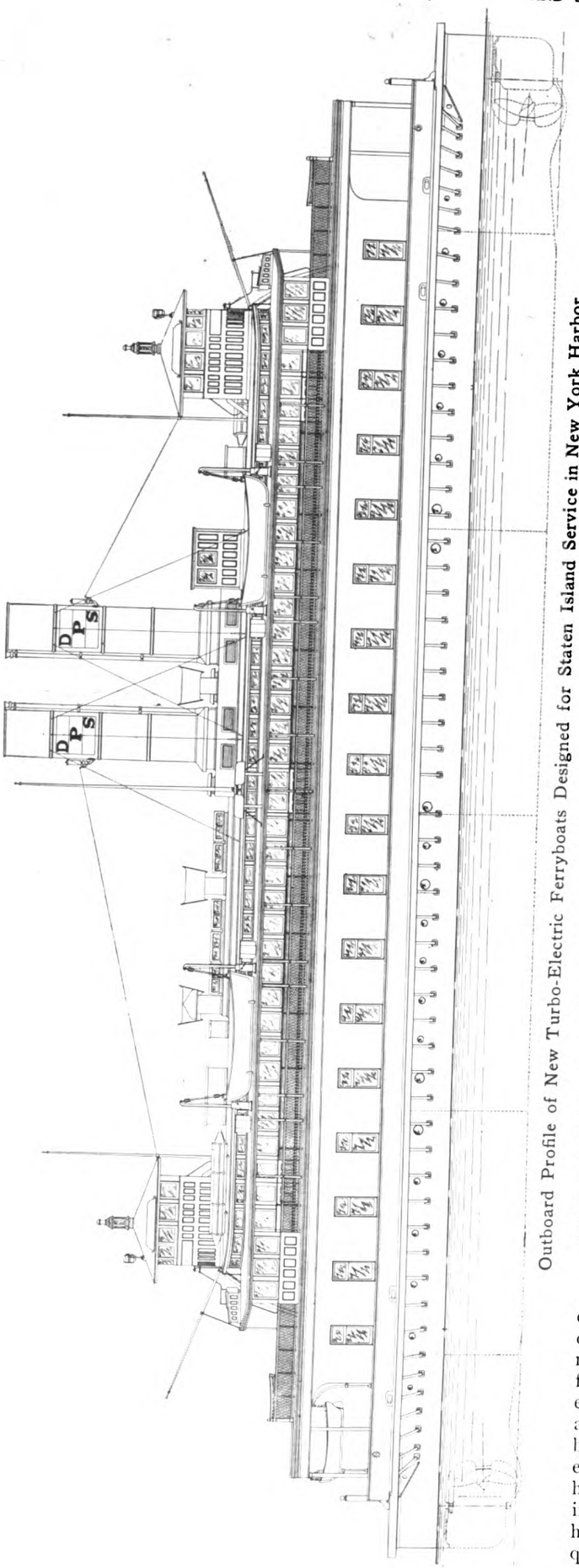

Outboard Profile of New Turbo-Electric Ferryboats Designed for Staten Island Service in New York Harbor

New Turbo-Electric Ferryboats for New York City

Three Turbo-Electric-Drive Vessels to Be Added to Staten Island Service in Connection with New Pier Developments

THE new pier developments on Staten Island which included the addition of twelve municipal piers to the six privately owned piers in that locality immediately brought up the question of proper facilities for handling freight to and from the seagoing vessels which will berth at these piers, and in order to meet the needs for increased ferry service the Department of Plant and Structures of New York City has prepared designs for three new turbo-electric-drive ferryboats which, when built, will take care of the needs of this new commercial enterprise.

These new ferryboats will operate between the foot of Cortlandt Street, Manhattan, and St. George, Staten Island. In view of the fact that the vessels are designed primarily to handle the trucking business to and from the piers, the lower deck will be devoted entirely to this end and will be arranged to provide four driveways. In addition to this, however, accommodations for passengers will also be provided, but the arrangements for passengers will be confined to the upper deck.

Bids for the construction of these vessels were submitted to the Commissioner of Plant and Structures on April 20 by the Staten Island Shipbuilding Company and the Tebo Yacht and Basin Company.

The Staten Island Shipbuilding Company bid $1,103,900 for two boats complete and $1,639,900 for three boats. The bid of the Tebo Yacht and Basin Company was for $1,160,000 for two boats and $1,730,000 for three boats.

HULL

The preliminary designs of the vessels have been prepared in such a manner that either transverse or longitudinal framing may be adopted, and this point was made a subject of alternative bids from the builders. The above bids in each case were based on transverse framing and the Staten Island Shipbuilding Company stipulated a reduction therefrom of $2,100 per boat, if longitudinal framing is adopted. A deduction on the same basis of $6,000 per boat, was stipulated by the Tebo Yacht and Basin Company.

Each vessel will be subdivided by 5 transverse bulkheads extending to the main deck and arranged as shown.

The longitudinal strength of the vessels will be maintained by a longitudinal truss arranged on each side of the centerline. On account of their size and the special conditions under which these vessels will operate it is doubtful whether ferryboats of a similar nature would be suitable for any city other than New York. The machinery arrangement, however, is particularly interesting as representing the trend of modern practice for ferryboat propulsion.

MAIN PROPELLING MACHINERY

The main propelling machinery consists of two main electric motors, one located at each end of the vessel, both of which are operated by a single turbo generator. The main turbine will be of the impulse, marine condensing, rigid frame, three-bearing type, direct connected to the main generator. This unit will have a capacity of 2,200 horsepower at the propeller shafts. The water rate of the turbine will be approximately 10.5 pounds per propeller shaft horsepower each with 250 pounds steam pressure, 200 degrees F. superheat at the throttle, and 28.5 inches of vacuum when delivering 2,100 horsepower at the stern propeller shaft and 100 horsepower at the bow propeller shaft, excluding the power required for excitation.

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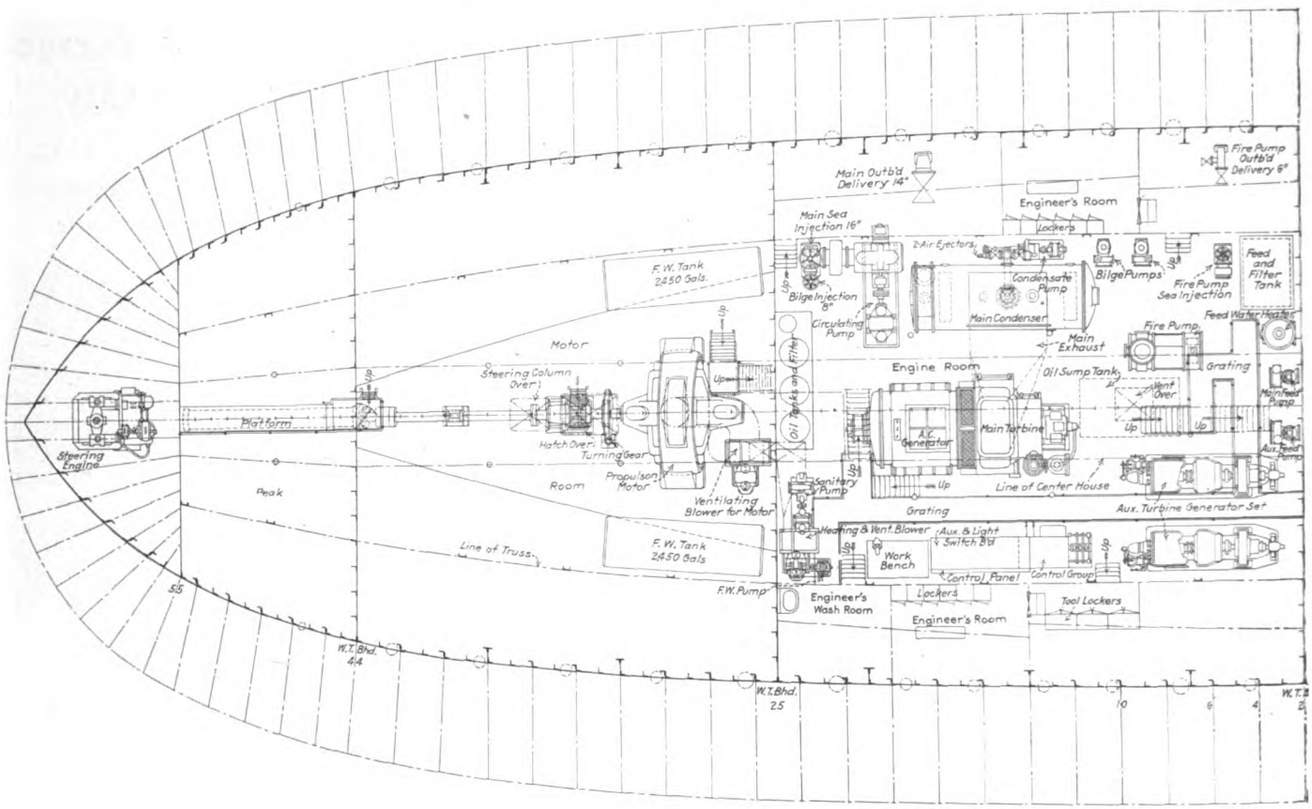


Hold Plan, Showing

The speed of the turbine will be approximately 3,000 revolutions per minute when delivering the full 2,200 shaft horsepower and it will be constructed to allow a speed variation from 30 percent of normal to the maximum required. Under the normal operating conditions the total horsepower will be 1,900 or about 1,800 at the stern propeller and 100 at the bow propeller.

As is customary in installations of this type, a governor will be provided which shall limit the turbine speed to 7 percent above normal and an emergency governor of the eccentric ring type will be provided which will operate should the speed above normal reach 11 percent.

MAIN GENERATOR

The main generator will be of the three phase, alternating current type, direct connected to the main turbine. It will have a capacity of 2,300-3,000 volts and a maximum operating speed of not less than 3,000 revolutions per minute. The excitation required at full load when delivering 2,200 horsepower at the propeller shafts will be approximately 20 kilowatts.

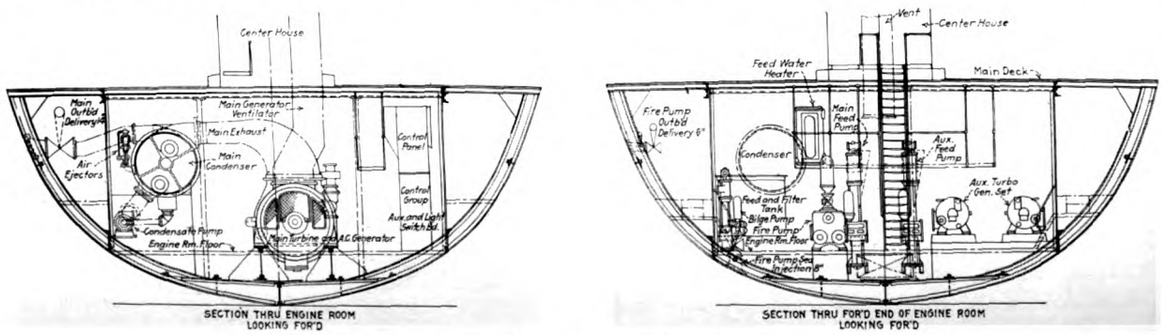
The stator frame will be made of cast iron in one piece and the punching ribs cast integral with the frame. The armature core will be built up of annealed and enameled segments of thin sheet iron designed and constructed so as to obtain a minimum core loss. Punchings will be secured to the stator frame by means of dovetailed keys and heavy cast iron flanges at each end will hold the core securely under high compression. Armature punchings will have open slots to permit the use of form wound coil with proper insulation. The winding will be made up of rectangular wire thoroughly impregnated with a high grade moisture resisting compound.

The rotor will be made of a one piece heat treated solid steel forging. This forging will form both the shaft and core of the rotor and the field portion of the magnetic circuit. The rotor winding will be made of suitable copper strips wound edgewise and insulated with mica tape.

The generator will be ventilated by centrifugal fans integral with the rotor.

MAIN PROPULSION MOTORS

The two main propulsion motors will be of the three-phase, alternating-current, induction type of 2,300-3,000 volts capacity. Each motor will be provided with a stator winding for operating the stern propeller at full speed and power



Transverse Sections Through Engine Room

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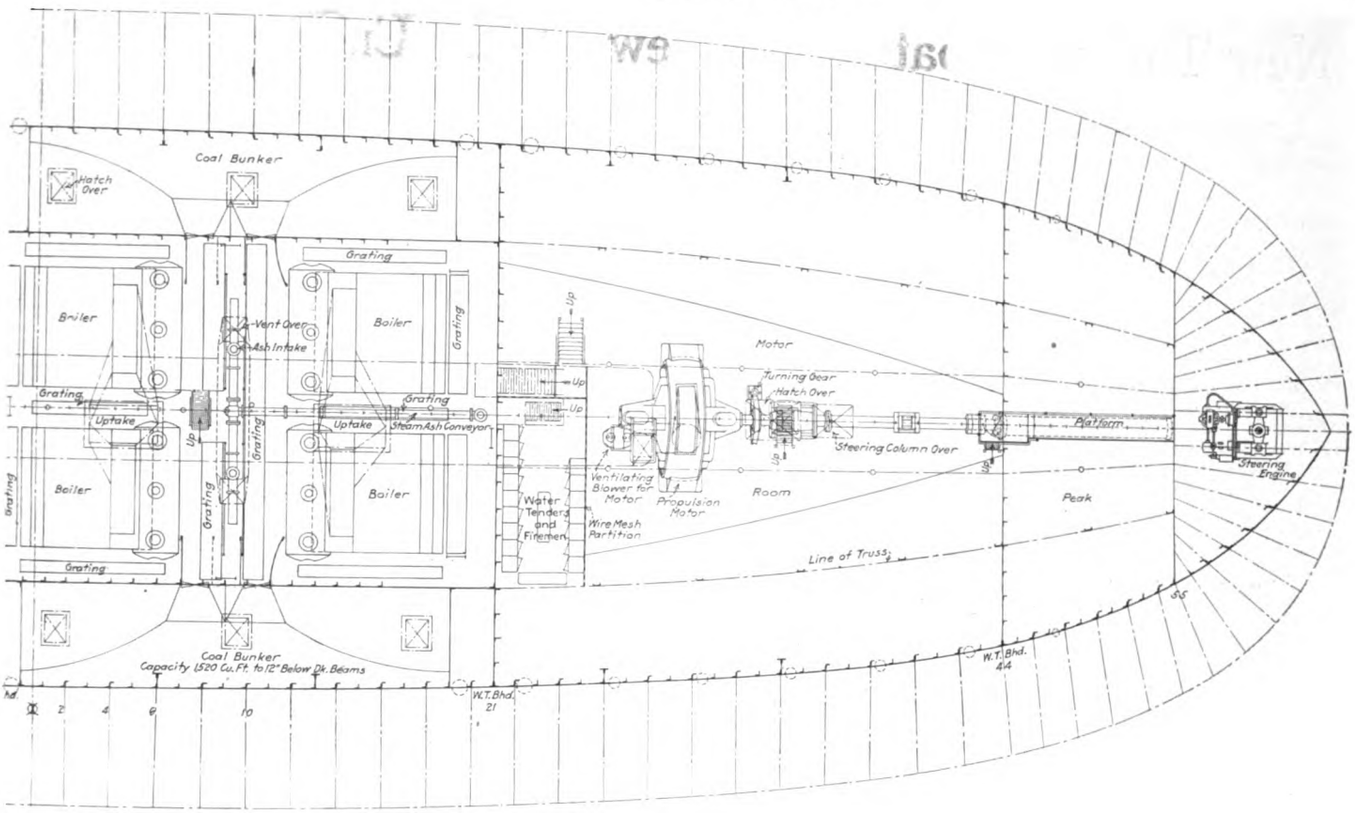


Machinery Arrangement

(2,100 horsepower and about 176 revolutions per minute) and a stator winding for operating the bow propeller at reduced speed and low power (about 100 horsepower and 132 revolutions per minute). This speed change will probably be secured by pole changing. The outside diameter of the motors will be approximately 10 feet.

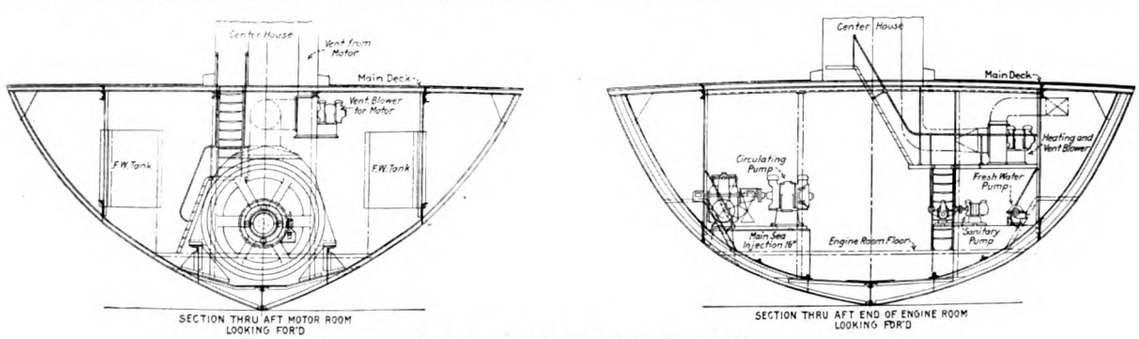
The stator frame will be made of cast iron and designed to resist deflection from strains due to weight of punchings and windings or to any magnetic pull. Frame and bearing brackets will be made watertight below the shaft center, and will be provided with means for draining any condensation that may occur.

The stator core will be built up of thin steel punchings secured to the frame by means of dovetailed keys attached to the ribs in the stator frame. Ventilation of the core and windings will be secured through radial ducts provided at suitable intervals along the length of the core and opposite similar ducts in the rotor. The stator coils will be made up of a suitable number of turns of rectangular wire with cotton and mica compound covering. The coils will be held in place in the slots by means of thin wedges of insulting material. The external ends of all coils will be laced to an insulated steel ring in such a manner as effectively to prevent vibration and this steel ring will be securely fastened to the stator frame.

The rotor spider will be made of cast steel keyed and pressed on the rotor shaft and the rotor shaft will be made of steel of sufficient size to insure rigidity under all conditions of service. The rotor core will be built up of segmental laminations made from thin steel which will be held by slots in dovetailed ribs of the rotor spider. Radial ducts and spacer fasteners will be provided similar to those for the stator. The windings will consist of two squirrel cage windings. The high resistance winding will be brazed with silver solder to the end rings and the low resistance winding will be welded to the end rings.

Bearings will be of the ball seated self-alining type split through the horizontal diameter.

The motors will be designed to operate continuously at full load and full speed on the full speed winding and at full load and full speed on the slow speed winding with a temperature rise by thermometer not exceeding 50 degrees C. based on an ambient temperature of 40 degrees C. when 13,000 cubic feet of air per minute are taken through each motor by a separately motor driven blower. When operating, the combined power factor of the stern motor and the bow



Sections Through Motor and Engine Rooms

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New Turbo-Electric Ferryboats for New York City

General Information

Service: Passenger and vehicle ferry between St. George, Staten Island and Manhattan, N. Y.

Owner: Department of Plants and Structures, New York City.

Characteristics

Length, over guards .....218′ 0″
Length, between end posts .....215′ 0″
Breadth, molded, at deck.....45′ 0″
Breadth, over guards .....64′ 0″
Depth, molded, amidship.....18′ 0½″
Draft, loaded .....
Draft, light .....11′ 0″
Block coefficient .....
Midship section, coefficient.....
Longitudinal coefficient .....
Speed, loaded, knots .....
Cruising radius, nautical miles.....
Framing .....
Class .....American Bureau Shipping for river and harbor service.

Estimated Tonnages

(In tons of 2,240 pounds)

*Weight of Hull 873.5
**Weight Propelling Machinery.....332.9
Deadweight Capacity .....
Displacement, light 1206.4

(In tons of 100 cubic feet)

Gross register .....
Net register .....

*Weight of Hull includes Hull Proper, Hull Fittings, Equipment and Outfit.

**Weight of Propelling Machinery includes Engines, Boilers (Wet), Shafting, Propellers, and Machinery Space Auxiliaries.

Rudder

Area .....
Dia. Stock, inches 9
C. Press. abaft C. L. pintles.....

Deck Machinery

Steering Gear, electric drum or electro-hydraulic type .....
Windlass .....
Capstans .....
Winches .....
.....

Life Saving Equipment

	No.	Type	Length
Lifeboats	1	.....	12′ 0″
Lifeboats	4	.....	18′ 0″
Liferafts	2	.....	

Propelling Machinery

Boilers

Number 4
Type .....Watertube
Length .....
Width or Diameter.....
Furnaces .....
Fuel .....Coal
Draft .....Natural or Forced
Total heating surface, square feet.....8,000
Totat grate surface, square feet.....196
.....
Superheat, degrees F. 200
Working pressure, lbs. per sq. in.....250
Normal fuel consumption:
Per day, tons.....
Per horsepower hour, pounds.....
Normal steam production:
Per hour per pound of fuel.....lbs.
Total per hour.....lbs.

Main Turbine

Number 1
Type, marine, impulse, condensing, rigid frame, three bearing.....
Horsepower 2,200
Speed, 3,000 R.P.M. at maximum horsepower .....

Main Generator

Number 1
Type, 3 phase, alternating current, direct connected to main turbine.....
Voltage 2,300-3,000
Operating speed .....3,000 R.P.M.
Excitation, not to exceed 20 K.W. when delivering 2,200 H.P.....
Weight, turbine and generator combined, approximately 60,000 pounds.....

Main Propulsion Motors

Number 2
Type, 3 phase, alternating current, induction
Voltage 2,300-3,000
Speed, stator winding for operating stern propeller 176 R.P.M. at 2,100 H.P. and bow propeller 132 R.P.M. at 100 H.P.
Weight, each motor.....60,000 pounds

Auxiliary Turbo Generators

Number 2
Type, direct current, 3 wire generator, 110-220 volts, driven by an impulse turbine through double reduction gears
Capacity .....125 K.W. each
Speed reduction, approximately 3,600 to 1,200 R.P.M.....

Emergency Lighting

(1) Set operating at 110 volts.

Auxiliary Motors

Marine, direct current, compound or shunt wound, commutating pole, self ventilating type operating at 220 volts.

Propellers

Number 2
Type .....Four-bladed solid
Weight .....
Diameter .....
Pitch .....
R. P. M. .....Forward 132, aft 176
Projected area .....
Developed area .....

Auxiliary Machinery

(Number, Size, Type)

Machinery Space

Condensers (1) 4,000 square feet cooling surface .....
Air ejectors (2) two stage, steam operated type. .....
Feed water heater 1
Oil coolers (2) heat absorption, about 3,000 B.T.U. per minute.....
Oil strainers 2
Oil separator 1
Injectors (2), to operate against boiler pressure of 250 pounds.....
Air compressor (1), stationary, motor-driven type with a capacity of 15 cubic feet of air per minute.....
Electric heaters (2), 500 watt (115 volts) heaters for each motor.....
Pumps:
(1) Circulating, centrifugal, capacity 5,000 gal. per min., direct connected to 40 H.P. elect. motor.....
(1) Condensate, centrifugal, capacity 120 gal. per min., direct connected 5 H.P. electric motor. .....
(1) Salt water service, centrifugal, capacity 100 gal. per min., direct connected 5 H.P. electric motor.....
(1) Fresh water, rotary type, capacity 25 gal. per min., motor driven.....
(2) Oil, rotary type, capacity 50 gal. per min., motor driven.....
(2) Feed, vert. simplex, steam 10 x 7 x 24 inches. .....
(1) Fire and general service, horizontal duplex, steam, 12 x 10 x 10 inches....
(2) Bilge, vert. simplex, steam, 7 x 7 x 12 inches. .....

---

motor, when run at normal full speed frequency and full load, will be approximately 70 percent. The combined power factor of the stern motor and bow motor when run at one-half load on each motor, will be not less than 70 percent when the generator excitation is reduced for the half load condition.

Each motor will be provided with two 500-watt (115 volts) electric heaters.

Control Apparatus for Main Units

The propulsion motors will function as follows:

Maximum field will be applied to the alternator and the stern motor started on its full speed winding. After it has accelerated, the bow motor will be started on its slow speed winding and the field of the alternator reduced to normal. The above connections will be reversed for backing. Slow to full speed will be effected by turbine speed variation and control. All ordinary maneuvering, including speed changes, stopping, starting and backing, will be controlled by two levers mounted on the control panel; one turbine lever (turbine throttle) for varying the turbine speed and one control lever for energizing, electrically through a controller, the solenoid-operated air break contactors which control the functioning of the main propulsion units. In addition to these control levers there will be an arrangement of interlocking, manual control levers for use in emergency.

A protective device will be installed in the circuits leading to each slow speed motor winding which will trip the line contactors in these circuits in case an overload occurs on either motor when operating on the slow speed winding. An emergency connection will also be provided so that in case one motor fails the other motor can be operated in either direction on its full speed winding.

Auxiliary Turbo Generators

Two direct current turbo generator auxiliary sets of 125 kilowatts capacity each will be provided. Each set will consist essentially of an impulse turbine and a direct current,

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three wire generator, of 110-220 volts capacity, operated through double reduction gears.

The turbine will be of the horizontal multi-stage type, with a water rate of approximately 21 pounds per kilowatt hour with 250 pounds steam pressure, 200 degrees F. superheat at the throttle and 28½ inches vacuum.

The turbine will be equipped with an oil-operated governor which will function at two percent overspeed and an emergency governor will be provided which will effectively shut off the steam supply at an overspeed of 10 percent.

The reduction gear, will be of the double reduction, straight line drive type, the speed reduction being approximately 3,600 to 1,200 revolutions per minute.

Generator and turbine will be mounted on the same bed plate. The generator will be flat compounded with three wire connections, etc., and of sufficient capacity to handle a 25 percent unbalanced load. An overspeed governor will be fitted which will operate on 10 percent above normal. The generator will be of the self-ventilated type.

Suitable connections will be provided to a switchboard in such a manner that either turbo generator, or both in parallel, can furnish current to the auxiliaries and the lighting circuits. The latter are to operate at 110 volts. Auxiliary motors are to take current across the outside wires of the system and operate at 220 volts.

Auxiliary Motors

All auxiliary motors will be of the marine, direct current, combined or shunt wound, commutating pole, continuous rated, self-ventilated, splash proof type, operating at 220 volts. They will be direct connected, generally, to their respective auxiliaries by means of flexible couplings.

Lubricating Oil System

A lubricating oil system will be installed for the main turbo generator, main propulsion motors and the auxiliary turbo generators. The system will include two gravity tanks located in the engine casing and connected through a duplex strainer to all bearings and thence to a common sump tank located under the engine floor. Duplicate oil pumps will draw from the sump tank through a duplex strainer and discharge through duplicate oil coolers to the gravity tanks, and connections will be fitted for by-passing the gravity tanks and discharging direct to the bearings through the strainer. The overflow from the gravity tanks will lead direct to the sump tank. In addition an independent line will be provided from the bottom of the sump tank to a pump discharging to a separator and then back to the sump tank.

Air Compressor

A single air compressor will be provided for blowing out coils, cleaning electrical machinery, etc. It will be of the stationary, motor driven, automatic control type with a displacement of approximately 15 cubic feet of air per minute.

The new ferryboats, when added to the present St. George ferries operating from the Battery, will add considerably to the facilities afforded for passenger and freight transportation to Staten Island. These new boats will be faster than those now in operation and it is also expected that they will operate more economically, resulting in a saving of from 20 to 22 tons of coal per day. The completion of the new municipal piers will increase in a very large measure the trucking traffic to the Island but these new, large and speedy ferryboats of the four driveway type are expected to amply provide for the efficient handling of this traffic.

Atlantic Refining Company Tanker R. D. Leonard Completed

ANOTHER vessel was added to the Atlantic Refining Company's fleet when the turbine driven single screw tanker *R. D. Leonard* was delivered to the company by the Harlan plant, Wilmington, Del., of the Bethlehem Shipbuilding Corporation, Ltd., on February 17.

The ship was built in accordance with Lloyd's 100 A-1 class for vessels to carry oil in bulk. The total carrying capacity is about 2,640 tons deadweight on a mean draft of 17 feet 1⅞ inches, with an oil cargo capacity of about 2,450 tons.

Atlantic Refining Company's New Tanker R. D. Leonard

The principal particulars of the vessel are as follows:

Length overall	276 feet 10 inches
Length between perpendiculars	266 feet 0 inches
Beam molded	39 feet 0 inches
Depth molded	20 feet 0 inches
Type of engine	Turbine
Boilers	Babcock & Wilcox
Number of boilers	2
Steam pressure, pounds per square inch	225
Kind of fuel	Oil
Speed on trial trip, knots	9.68

The propelling machinery consists of a single De Laval steam turbine, with double reduction gears, capable of de-

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veloping a normal shaft horsepower of 750 at 95 revolutions per minute, and a maximum shaft horsepower of 900 at about 101 revolutions per minute. The Bethlehem-Dahl mechanical oil burning system is installed, operating under either natural or forced draft.

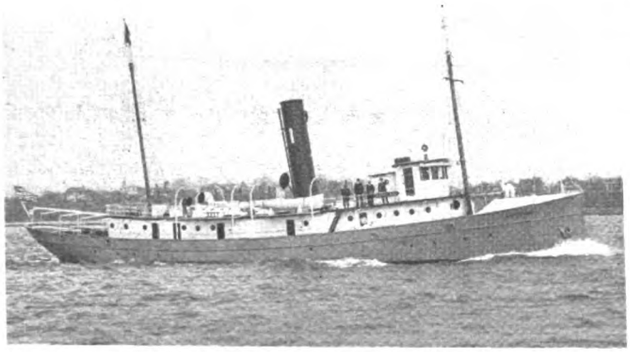
The oil pumping machinery consists of the following: Two vertical duplex compound cargo pumps, 7 inches by 12 inches by 10 inches by 12 inches stroke; fuel oil transfer pump, horizontal duplex type, 6 inches by 5¾ inches by 6 inches stroke; and two fuel oil service pumps, horizontal duplex type, 4½ inches by 2¾ inches by 4 inches.

The main feed pump and general service pumps are both vertical simplex, 10 inches by 6 inches by 18 inches stroke.

The deck machinery was built at the Moore plant of the Bethlehem Corporation, at Elizabeth, N. J., and consists of an 8-inch by 7-inch spring quadrant type steering gear with horizontal engines; an 8¼-inch by 8-inch spur-gear windlass; and a 6¼-inch by 8-inch steam self-contained gypsy-capstan.

Steam Pilot Boat Maryland Completes Her Trials

THE new steam pilot boat *Maryland*, built for the Association of Maryland Pilots, at the Tebo plant, Brooklyn, N. Y., of the Todd Shipyards Corporation, from the designs and specifications of Cox & Stevens, naval architects, New York, was given a successful trial trip at sea



Pilot Boat Maryland

off New York harbor on March 29. The *Maryland* will be put in service as the station vessel off Cape Henry.

Principal Dimensions

Length over all	150 feet—0 inches
Length between perpendiculars	140 feet—3 inches
Beam molded	25 feet—0 inches
Depth molded	15 feet—7 inches

Intended for Steam Trawler

The vessel was originally designed as a steam trawler by Cox and Stevens. After construction was started she was purchased in an incomplete condition by the Association of Maryland Pilots. The design was then revised so that the vessel as now completed represents, both in construction and equipment, an ideal type of pilot boat.

The hull is constructed of steel in excess of Lloyd's requirements. The vessel has two pole masts and is flush decked with a straight stem and a turtleback forward. She has a well proportioned elliptical stern aft, the freeboard being ample and the sheer unusually lively.

There is a continuous steel deck house on the main deck. At the forward end of the main deck house there is a pilot house containing the captain's room and navigating room. At the after end is a large smoking room comfortably furnished with tables, seats, and so forth, which communicates directly with the pilots' living quarters which are on the deck below.

Forward of the smoking room on the starboard side is the chief engineer's stateroom and on the port side a stateroom for the assistant engineer, both communicating directly with the machinery space which is just forward of their staterooms.

The steering engine is located on the main deck just forward of the machinery compartment.

Forward of the boiler enclosure is the galley and the pantry and at the extreme forward end of the house is the main room, which is handsomely furnished and of sufficient size to permit ample accommodations for the pilots.

The space under the turtleback forward contains the capstans and also the lavatories and toilets as well as storerooms for deck supplies and other equipment.

At the after end of the main deck over the quadrant are fitted large stern gratings and there is a very heavy towing bitt as well as the usual equipment of chocks, bollards and cleats.

Pilots' Quarters

Below deck, the pilots' main living quarters occupy the after part of the vessel and are unusually large and comfortably arranged. In this compartment are accommodations for sixteen pilots, each having a separate bunk and locker space for clothes. A bath room and ample wash facilities are provided.

Crew's Quarters

Below, forward of the boiler room, are the quarters for the crew proper and also accommodations for apprentices. On the starboard side is a large refrigerator, the ice machine room being adjacent thereto and also staterooms for stewards, messman and cabin boy, while on the port side are staterooms for the oilers and firemen as well as a large storeroom for provisions.

In the lower forecastle, which is arranged for apprentices and for additional members of the crew, are ten berths with the usual transoms and clothes lockers. Forward of this space is a storeroom with chain locker underneath.

Machinery

The engine, which is of the compound type, having cylinders 18 inches and 38 inches in diameter with a 26-inch stroke develops 650 horsepower. Steam is supplied by a Scotch boiler 14 feet 6 inches in diameter and 12 feet in length. The boiler has three furnaces and 2,500 square feet of heating surface. A donkey boiler is also installed.

Auxiliary Machinery

The following auxiliary machinery is installed:

Circulating pump—centrifugal type—6-inch discharge.
Feed pump—horizontal duplex type—7½ × 5 × 10.
Donkey pump—vertical duplex type—7½ × 4½ × 8.
Fire and bilge pump—horizontal duplex type—7½ × 4½ × 8.
Fresh water pump—horizontal duplex type—4½ × 3 × 4.
Generator—10 kilowatt—and storage batteries.
Ice machine—one-ton capacity.

Navy Machinery Specifications.—The Bureau of Engineering, of the Navy Department, is furnishing the Engineering Schools of many of the colleges of the country with copies of its General Specifications for Machinery. These specifications represent modern practice in naval engineering, and with their several appendices describing methods of inspection, etc., are practically text-books on this highly specialized subject.

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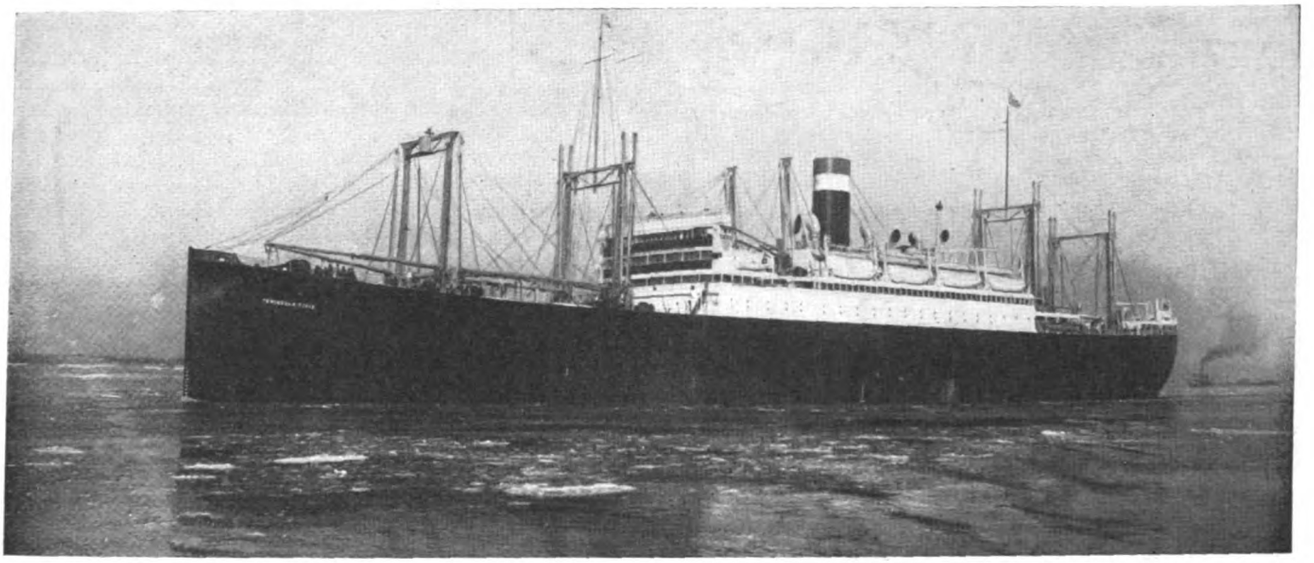

Fig. 1.—S. S. Peninsula State, the Last of a Group of 535-Foot Passenger Vessels Built by the New York Shipbuilding Corporation, Camden, N. J., for the Shipping Board, on Her Trial Trip Early in February. The Peninsula State Has Been Allocated to the United States Lines

America Develops New Atlantic Passenger Service

United States Lines to Operate Nine "State" Ships Specially Adapted for Passengers of Moderate Means—Equivalent of Second Class Accommodations Offered to Pasesngers at Third Class Rates

ONE of the features of transatlantic passenger traffic this year will be the facilities afforded European travelers by the United States Lines to sail in American ships.

This farsighted steamship agency has arranged to operate nine Shipping Board vessels of the "State" class on the North Atlantic run and in addition to providing cabin accommodations of the highest type will cater particularly to passengers of limited means who contemplate going abroad. The vessels will be arranged to maintain a bi-weekly schedule to Europe and this will be increased to three sailings weekly should conditions warrant.

Plans for reconditioning the vessels with a view to increasing the comfort of passengers and extending the accommodations to allow for substantial reductions in rates have been prepared under the supervision of Mr. Carl E. Petersen, naval architect for the United States Lines.

VESSELS BEING RECONDITIONED

At the present time the *Old North State* and *Panhandle State* are cabin ships, and the *Centennial State* carries cabin and third class. The *Granite State* and *Blue Hen State* will each carry 176 cabin and about 400 third class in rooms, both of these ships being scheduled to sail in June. The *Lone Star State* and the *Peninsula State* carry about 205 first class and 234 third class passengers and the *Hawkeye State* and the *Buckeye State* will be fitted up to carry 250 first class and 320 third class passengers.

The conversion of the *Old North State* has recently been completed at the Morse Dry Dock and Repair Company's plant at Brooklyn, N. Y., and this vessel entered the New York-Plymouth-Cherbourg-London service on March 14. The work on this vessel is similar to that proposed for the cabins of the 502-foot class vessels and the changes consisted chiefly in removing one of the two beds from each room and substituting a sofa bed at the outboard side ingeniously arranged to accommodate two persons and installing a folding Pullman berth over the remaining bed. The new arrangement is shown in Fig. 2 and by this means accommodation is provided in each room for 1, 2, 3 or 4 persons.

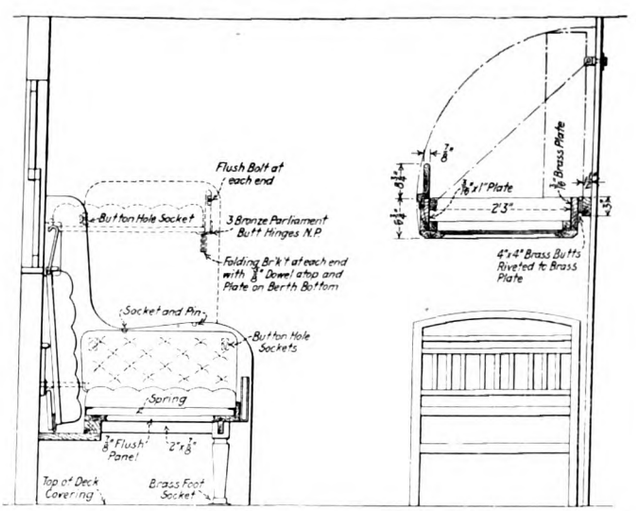

Fig. 2.—Typical Section, Showing New Arrangement of Cabin Staterooms

CHANGES IN THIRD CLASS ACCOMMODATIONS

The most radical changes are being made in the third class accommodations. It is generally known that the greatest returns to a steamship company are made from the lowest class accommodations and on account of this the pre-war

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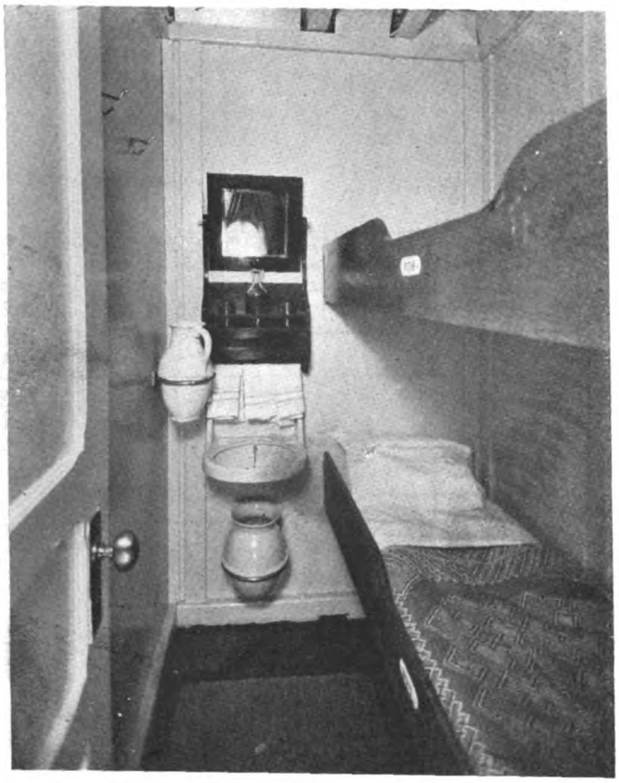

Fig. 3.—S. S. Lone Star State—Typical Third Class Stateroom

custom was to provide accommodations for the greatest number and the comforts afforded were a minimum. This has all been changed under the new plans of the United States Lines and in these American ships every means will be provided for adding to the comfort of this class of traveler.

The old time steerage quarters have been replaced with neat staterooms arranged for two, three, four or six persons and fitted with lavatories and other conveniences. The decks are covered with carpet and composition decking and built-in berths with hardwood leeboards and metallic springs are provided.

Public Rooms

In addition to the individual staterooms there have been provided for the third class passengers public rooms, including a ladies' lounge and a smoking room for men. Well filled bookcases, a victrola and a piano add to the facilities for pleasure. A large dining room is provided and a feature of this room is the substitution of swivel chairs for the long benches which were formerly used. The piano is located in this room and arrangements are made for removing the chairs and tables, in this manner providing a clear deck space for dancing. A barber shop adds to the conveniences offered and ample promenade deck space is provided for outdoor lounging and recreation.

Every need of the prospective passenger has been considered. The decorations have been studied and adapted to please the most fastidious. Upholstered settees invite one to rest and the whole scheme has been worked out to such a nicety that what is really offered is second class accommodations at third class rates.

Old-Fashioned Steerage Abolished

This new idea is bound to meet with universal approval and many who have hesitated about undergoing the hardships of a steerage passage to Europe will now find it within their means to go abroad in American ships and be assured of every comfort.

Not of the least importance in the new plans of the United States Lines is the reduction in price afforded. One can now travel in comfort to Queenstown, Plymouth or London for $85.00 or to Bremen for $103.50.

The plans and specifications for the conversion of these vessels were prepared by the technical staff of the United States Lines and the work is being supervised by Mr. Petersen, their naval architect, in collaboration with Mr. A. D. Woods of the Shipping Board. The work on the *Lone Star State* was completed on March 17, that on the *Peninsula State* on April 16 and that on the *Centennial State* on April 28 at the Robins Dry Dock and Repair Company's plant in Brooklyn.

Every effort is being made by the Shipping Board through Mr. T. Rossbottom to provide an incentive for Americans to sail in American ships and, while the cost of reconditioning this fleet involves a heavy expenditure, it is expected that a return more than offsetting it will be derived from increased patronage. That such will be the case is already indicated by the increasing demands for reservations which are constantly coming in.

The vessels of the United States Lines are already booked solid for passage to Europe until the 26th of July and practically full bookings are carried for the return trip extending to the middle of October.

Fig. 4.—S. S. Lone Star State—Third Class Ladies' Lounge

Fig. 5.—S. S. Lone Star State—Third Class Smoking Room

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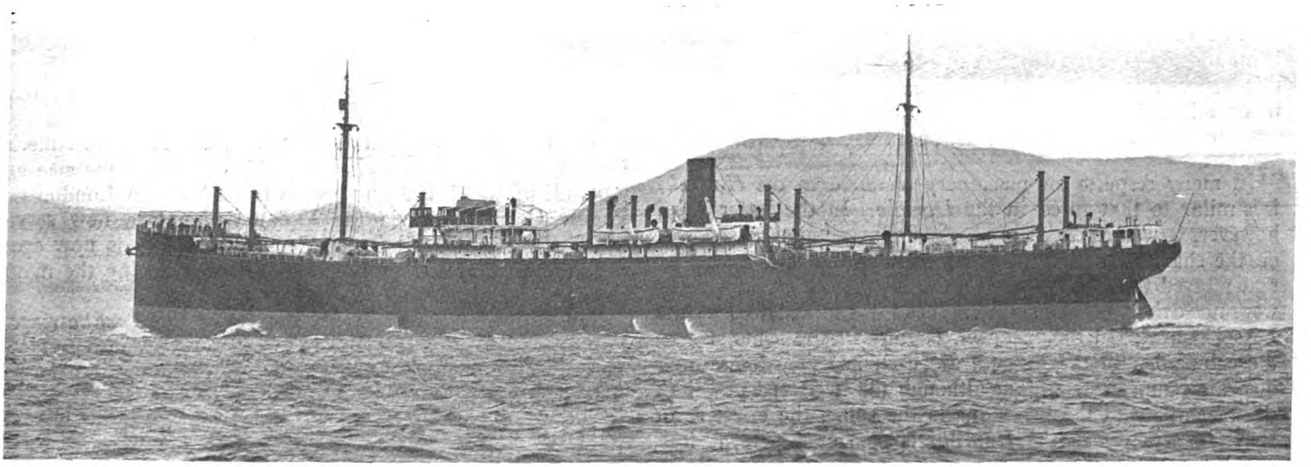


Motorship Hauraki Built for the Union Steamship Company of New Zealand

Large British Steamship Companies Build Motorships

First Diesel-Engined Vessels Completed for Union Steamship Company and Royal Mail Steam Packet Company

By Our Special London Correspondent

IN spite of the shipbuilding depression in Great Britain and the fact that no orders of any consequence have been placed during the past twelve months, an increasing number of motorships have been completed, since orders were placed two years ago or more which have not yet been fulfilled.

The *Hauraki,* which ran her trials in the Clyde in March, is the first oil engined ship built for the Union Steamship Company of New Zealand (owners of 82 steamers), and it is understood that she will trade between Vancouver and New Zealand, being the first ship with internal combustion engines to be placed on this route.

CARGO MOTORSHIP HAURAKI

She was built by William Denny & Brothers, Dumbarton, and in general hull form and dimensions is practically identical with the motor passenger liner *Domala,* of which a full description was published in the February issue of this journal. The *Hauraki,* however, is purely a cargo ship on which none of the passenger accommodation of the *Domala* is included.

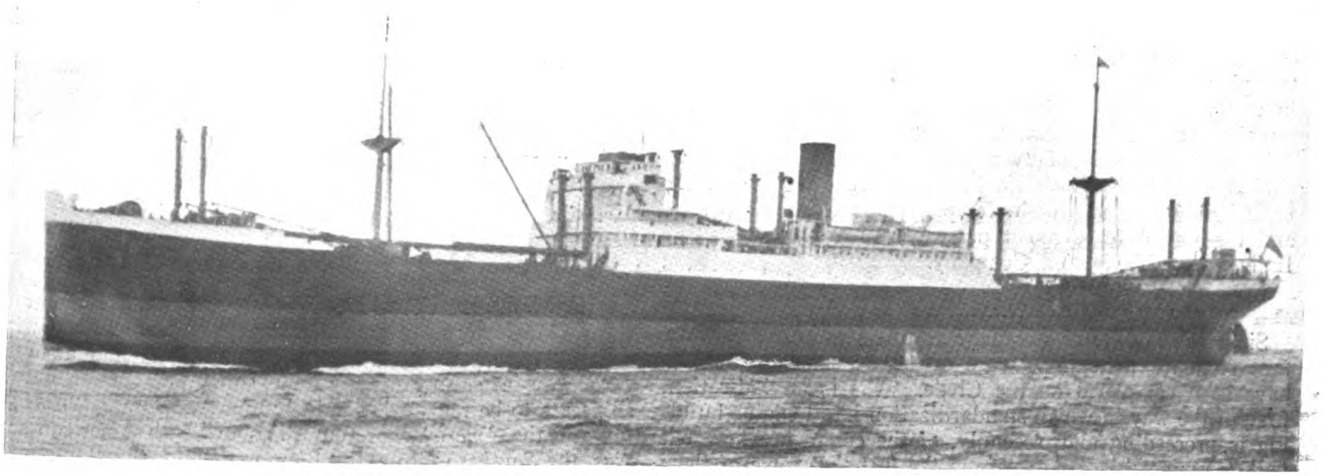
The main dimensions are as follows:

Length overall	464 feet
Length between perpendiculars	450 feet
Maximum beam	58 feet
Depth to the upper deck	35 feet 6 inches
Deadweight capacity, including fuel	10,850 tons

COMPARISON WITH SIMILAR STEAMSHIPS

The engine room is amidships and there are two cargo holds forward and two aft. In the double bottom is carried oil fuel to the extent of about 1,000 tons, which will give a radius of action of some 18,000 miles. As the vessel will be engaged upon long distance services, this large radius of action is an asset of considerable importance and the *Hauraki* will be able to bunker at San Francisco, where oil prices are low, and make the round voyage to New Zealand and back without having to take on more fuel.

It is interesting to note that the machinery of the *Hauraki*



Royal Mail Steam Packet Company's Motorship Lochkatrine

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weighs approximately the same as that of a corresponding steamer including the boilers, but in the motor vessel there is an additional cargo capacity due to the absence of bunkers, this representing an extra profit earning space of several thousand cubic feet.

AIR COMPRESSORS DRIVEN FROM MAIN ENGINES

In many respects the machinery installed in the *Hauraki* is similar to that fitted in the *Domala*. In the latter ship, however, it was essential to obtain the maximum horsepower on the shaft with a given cylinder dimension and it will be remembered that for this reason the injection air compressors were not driven off the main engines but coupled to separate Diesel motors. In the *Hauraki*, engines of the same size as those installed in the *Domala* are used but they drive their own air compressors so that although the indicated power of the machinery of the two ships is the same, the effective or shaft horsepower in the *Hauraki* is some ten percent less, this being absorbed by the compressors.

A further result of this rearrangement is that the auxiliary machinery in the *Hauraki* is simplified and the only air compressing plant beyond that on the main propelling engines is an electrically driven compressor coupled to a 230 horsepower motor.

PROPELLING MACHINERY

The propelling engines were built by the North British Diesel Engine Works at their new factory erected specially for the construction of marine Diesel machinery. The four-cycle principle is adopted and the motors are of the eight cylinder type with cylinders 26½ inches bore and 47 inches stroke. The low speed of rotation, namely 96 revolutions per minute, at full power is noteworthy in view of the fact that in most four-cycle Diesel engines of this output the speed is about 115 revolutions per minute.

The chief novelty in the detailed design of these engines, and it is one which has not attracted altogether favorable comment, is that in reversing, before the valve levers can be brought over the astern cams, the camshaft is allowed to fall bodily and then move fore and aft. The system has, however, worked satisfactorily on the *Domala* and is apparently completely successful in service. The arrangements of the injection air compressors have never previously been adopted and it is interesting to see that each engine has two three-stage compressors driven from the crankshaft by a connecting rod of V-section. On trials a speed of 13¼ knots was attained but the average sea speed will be in the neighborhood of 12½ knots when it is anticipated that the fuel consumption will not exceed 14 to 15 tons daily.

Like the vast majority of British built motorships, the auxiliary machinery on the *Hauraki* is wholly electrically driven. The generating plant comprises three 200 brake horsepower four cylinder Diesel engines of the North British type, driving 220 volt dynamos. At sea one set will be sufficient for all purposes. When loading or discharging cargo two plants will be required, so that one will always stand in reserve. The cargo handling machinery is exceptionally complete and 12 electric winches are fitted on deck.

Two further sets of twin screw machinery of exactly similar type to that installed in the *Hauraki* are now being built by the North British Company, one for a cargo ship and the second for a motor passenger liner for the British India Steam Navigation Company.

THE LOCHKATRINE—A 14,000-TON MOTORSHIP

Since the middle of February of this year no fewer than four standard motorships, each of 14,000 tons deadweight, have been completed on the Clyde. This is an indication, first, of the way in which standardization in oil engine building is proceeding and, secondly, of the confidence now felt in large motorships. Apart from the fact that some of them are intended for special trades and have larger refrigerating capacity than others, they are identical in every detail and the cost of construction is thereby reduced.

One of these ships, the *Lochkatrine*, of which an illustration is reproduced, represents the Royal Mail Steam Packet Company's first incursion into motorship owning. In conjunction with their associated concern, the Holland-America Line, they are building six motorships of the same size and type, all of which are destined to trade between London and Pacific Coast ports via the Panama Canal, a new service which the Royal Mail Steam Packet Company is now opening out. Clearly British shipowners are attacking the motorship problem in no niggardly spirit.

The following are the main details of the *Lochkatrine:*

Length overall	502 feet
Length between perpendiculars	485 feet
Maximum beam	62 feet
Depth	38 feet 6 inches
Gross tonnage	9,500
Deadweight tonnage	14,000
Indicated horsepower	6,400
Speed, knots	13-13½

There is comparatively little to be said concerning the machinery installation of the *Lochkatrine* as it represents the standard Burmeister and Wain practice as followed by the builders, Harland and Wolff. The two eight cylinder engines of 3,200 indicated horsepower each have cylinders 740 millimeters diameter and 1,150 millimeters stroke, the propeller speed being 115 revolutions per minute. Fuel consumption, including the oil required for driving the auxiliary machinery, works out at 20 tons daily, which is rather less than a quarter of the weight of coal needed in a corresponding coal fired steamer.

ELECTRICAL EQUIPMENT

The engine room represents something in the nature of a small central electric generating station for there are no fewer than four 100 kilowatt generators coupled to three cylinder Diesel engines of 150 brake horsepower. At sea, although one engine is sufficient to supply the power required for the auxiliary generating plant, two are actually kept in operation as it is considered that by running them on light loads their life is prolonged and the attendance necessary is considerably decreased. It is true that the fuel consumption is slightly higher than it otherwise would be, since it is clearly uneconomical to run Diesel motors at about one-third full load but in any event the oil required for this purpose is so small that the point is insignificant.

On deck, where all the winches are electrically operated, there are seven of the new four barrel type known as the McFarlane design which are capable of working four derricks at a time. Eight 7-ton electric winches of the ordinary pattern are also fitted on deck and the anchor windlass, steering gear and all engine room pumps are coupled to electric motors. There is only a small heating boiler installed which is kept in operation when the ship is in a cold climate.

The other three sister ships which as previously mentioned have been in commission since February, are the *Dinteldyk* for the Holland-America Line, and the *Glengarry* and *Glenbeg* for the Glen Line, which already has two vessels of the same size in regular service.

Shipping Board Vessels to Be Named After Presidents of the United States

THE Shipping Board has decided to rename the 502- and 535-foot passenger and cargo ships now named with state nicknames, such as *Nutmeg State,* and also the *Leviathan,* after presidents of the United States. Eighteen ships are to be renamed, not including the *George Washington* and the *America,* nor four ships in South American service, the *Southern Cross,* the *Western World,* the *Pan-American,* and the *American Legion.*

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Mauretania Converted Into an Oil Burner

Improvement Reduces Boiler Room Force by 228 Men and Shortens Time of Fueling from 3 Days to 7 Hours

THE famous Cunard liner *Mauretania,* which was built by Swan, Hunter and Wigham Richardson, Limited of Wallsend-on-Tyne, England, and delivered to her owners in the fall of 1907, has recently arrived in New York on her maiden voyage as an oil burner. The work of converting this vessel to an oil burner was assigned to the Swan, Hunter and Wigham Richardson yard last September and it took a little less than six months to complete the job.

In addition to the oil burning system, the ship underwent extensive repairs and alterations. There had been a fire on board the ship when she was at Southampton last summer, which destroyed a few cabins on the deck below the first class dining room. All of this accommodation was restored. The whole of the dining room deck, however, had to be dismantled, the steel plates removed and the deck beams taken out and made fair. The whole of the beautiful carved oak panels and pillars in the magnificent dining hall were taken down and scraped and finished with beeswax polish, this restorative greatly enhancing its beauty. A large amount of similar work was done to the music room and lounge, the smoking room, the library, the second class public rooms and to a large number of staterooms.

HOLDS THE SPEED RECORD

The speed record of the *Mauretania* has been unsurpassed. Messrs. Swan, Hunter and Wigham Richardson, Limited, originally contracted to guarantee a round voyage across the Atlantic and back, under picked conditions, at 24½ knots. The performance of the ship greatly exceeded expectations, for in one year she did 27 consecutive trips acrosss the Atlantic in all weathers, at an average speed of 25½ knots. Her fastest voyage all the way across the Atlantic averaged 26.06 knots, 27 knots being run for one whole day. No other ship has been able to touch this performance, which is a very remarkable record.

As the competition in speed between rival shipowning companies in the North Atlantic has died down, it is quite possible that the Cunard Steamship Company will not try to see what is the highest speed at which the *Mauretania* can run with oil fuel. All the same, it is certain that she can show an even better performance than her record of 26.06 knots average speed across the Atlantic, if required.

PRINCIPAL CHARACTERISTICS

Length over all	790 feet 0	inches
Breadth	88 feet 0	inches
Molded depth to shelter deck	60 feet 6	inches
Draft to freeboard	36 feet 2½	inches
Launching weight including cradle	16,800	tons
Gross tonnage	32,000	tons
Displacement tonnage	44,640	tons

Main propelling engines—2 high pressure and 2 low pressure ahead turbines, and 2 astern Parsons turbines, 180 revolutions per minute.

Boilers—23 double ended and 2 single ended cylindrical boilers working under Howden's forced draft, with a steam pressure of 195 pounds per square inch.

Number of furnaces	192	
Grate area	4,060	square feet
Heating surface	150,000	square feet

The boilers are divided into four groups, each in a separate watertight compartment. The uptakes lead to four elliptical funnels. The whole range of the boiler rooms is protected on each side by continuous watertight bunkers, which have now been made oiltight to carry oil fuel.

The former coal carrying capacity of the side bunkers, including a forward cross bunker, was about 6,000 tons. The oil carrying capacity of the side bunkers alone is now 5,350 tons. This excludes the forward cross bunker which is not used for fuel.

The installation of oil burning apparatus was carried out by the Wallsend Slipway and Engineering Company, the builders of the ship's turbines and boilers. The oil burning apparatus is of the Wallsend-Howden system, which has a world-wide reputation for high efficiency.

OIL BURNING INSTALLATION

Each boiler room has a transfer pump to bring oil to a settling tank which is provided with heating coils to bring the oil to a proper degree of fluidity before it is passed to the burners. In each boiler room there is a spare heating and pumping unit as a standby. Oil is loaded into the ship at four points, two on each side above the main deck. There is a wonderfully complete set of piping and valves, so that oil may be supplied to or pumped from any one tank at will. Air escape pipes are fitted to every oil tank and they can also act as overflow pipes with connection to the main pipe lines on each side of the ship.

The ship had accommodation for 198 firemen and 120 trimmers.

Owing to the fact that the ship is now burning oil fuel, the total number of boiler room attendants will now be only 90. This means dispensing with the services of no less than 228 men, which is a remarkable economy in addition to the greater efficiency gained in the consumption of fuel by the use of oil burners.

The *Mauretania* can now be fueled in seven hours as compared with three full days for coaling. This permits her to make a complete turnaround every three weeks whereas under coal it required four weeks. With oil stowage, some of the space formerly occupied by the coal bunkers is made available for other purposes. This is also true of the space occupied by the 228 extra men that are necessary to man the ship as a coal burner so it is apparent that, even if the price of oil is increased to a point where it would be more economical to burn coal in a freight ship, the advantages of space, personnel and turnaround would still favor the use of oil in the large express liners.

120-Ton Sperry Gyro-Stabilizer to Be Installed in Hawkeye State

A GROUP of prominent naval architects and shipping men were given an opportunity to witness a test of a 120-ton Sperry gyro-stabilizer at the plant of the Westinghouse Electric and Manufacturing Company at South Philadelphia on Thursday, April 13. This stabilizer is to be installed in the Shipping Board steamer *Hawkeye State,* which is now running between Baltimore and Honolulu.

At a luncheon which preceded the inspection, the inventor, Mr. Elmer A. Sperry, explained that it was possible for a relatively small stabilizer to control a large ship and keep her on an even keel because it absorbed the wave increments at their inception. Rolling, he asserted, was due to a piling up of wave increments but the stabilizer prevented such an accumulation of forces and, for this reason, it could be placed most anywhere in a ship without unduly stressing the structural members of the vessel.

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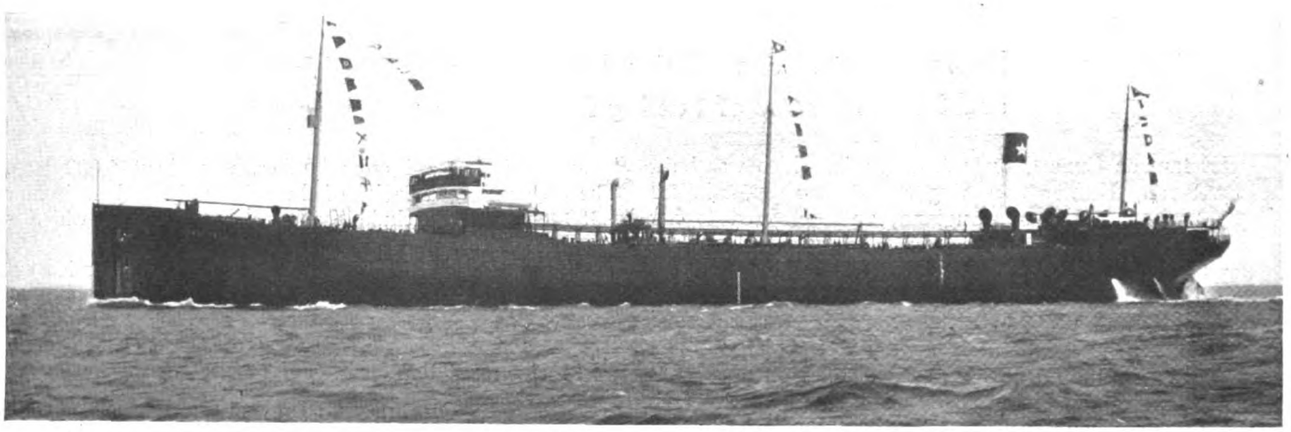

Southern Pacific Oil Tanker Tamaihua, of 17,200 Tons Deadweight

Southern Pacific Oil Tanker Tamiahua

Largest Merchant Vessel Built on the Pacific Coast —Details of Propelling Machinery—Trial Trip Data

By Henrik Greger*

THE continued demand for oil in the past few years gave impetus to great activity in the building of tanker tonnage by many of the various oil companies. The Southern Pacific Railway Company, which uses oil-burning locomotives exclusively and has a large number of oil-burning vessels, recently added to its fleet the S. S. *Tamiahua* built by the Moore Shipbuilding Company, Oakland, Cal. The vessel was designed and constructed under the supervision of A. S. Hebble, superintending engineer of the Southern Pacific Company-Atlantic Steamship Lines, and represents the most advanced ideas and practices in tank ship design.

The vessel has a total deadweight carrying capacity of 17,200 tons and is of the following general dimensions:

Length overall	516 feet 4 inches
Length between perpendiculars	500 feet
Depth molded	39 feet
Beam molded	71 feet
Mean draft	29 feet 3 inches
Speed	11 knots

The propelling machinery located aft, with separate engine and boiler rooms, consists of a vertical inverted quadruple expansion engine built by The Hooven, Owens, Rentschler Company, Hamilton, O., especially designed for the vessel.

The vessel is a single screw tank ship of the shelter deck type, with straight stem and elliptical stern, rigged with three steel pole masts. There are complete steel shelter, main and lower decks with an expansion trunk in way of the oil tanks.

The hold is divided into ten tanks with a centerline bulkhead extending under deck, dividing the tanks into port and starboard compartments. The wing spaces between the main and upper deck in way of the main oil tanks are divided into six compartments on each side and fitted as summer tanks. The pump room is located amidships. A fuel oil tank is fitted between the cargo tanks and the boiler room with a cofferdam between the fuel tanks and the boiler room. A double bottom is fitted in the engine room and boiler room for carrying fresh water or ballast.

Accomodations for the captain and deck officers are provided in a double tier of steel deck houses amidships. These houses are raised 3 feet 6 inches above the deck in order to be free of any gasses that might leak through the tank tops. The wheel house and chart house are of steel, built on top of the upper house. Quarters for the engineers, firemen, messrooms, etc., are provided in a steel deck house on the shelter deck abreast of the engine casing. The galley is located aft of the machinery casing on the shelter deck. Quarters for petty officers, seamen, cold storage, hospital and storerooms are located at the after end of the upper deck abreast the machinery casing. A steel house is provided on the after shelter deck fitted with an auxiliary steering gear. The top of this house is fitted with a warping bridge.

The vessel is built on a combined system of longitudinal and transverse framing of the Isherwood system, with scantlings and material as required by the American Bureau of Shipping classed A-1.

Cargo Oil Pumps

The cargo oil pumps consist of two horizontal duplex compound pumps with cylinders 19 by 30 by 16½ by 24 inches. Each pump is capable of discharging 3,500 barrels of oil per hour. The pumps have 18-inch suctions and 14-inch discharges. They take suction for a 14-inch main from both the forward and after ends of the vessel, which gives an exceptionally low velocity of oil in the suction lines. These pumps are designed with large valves and have 135 percent valve area in the oil ends. In addition, there is a stripping pump of the vertical duplex type, 16 by 10 by 18 inches, connected to an independent system of piping for stripping the cargo tanks to a lower level than it is possible to take the oil with the main pumps. The fuel oil feed pumps are of the horizontal duplex type, 7½ by 5 by 10 inches.

There are three single ended Scotch boilers with four furnaces in each boiler. The boilers are 15 feet 9 inches inside

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diameter, 12 feet long outside of the heads and are built for a working pressure of 230 pounds per square inch. The total effective heating surface of the boilers is 9,900 square feet. The furnaces are 41 inches inside diameter with 2¾-inch tubes. The boilers are fitted with heated forced draft and are arranged for burning oil.

There are two 84-inch forced draft fans manufactured by John Reid and Company, driven by twin 8 by 6-inch engines, with one engine in reserve. These fans are capable of producing 1-inch air pressure at the burners.

There are two main feed pumps of the vertical simplex type, 12 inches by 8 inches by 24 inches.

AUXILIARIES

The main condenser has a cooling surface of 11,000 square feet and the auxiliary condenser a cooling surface of 6,000 square feet.

The main air pump is driven off the main engine and is 30½ inches diameter by 25½ inches stroke. The main circulating pump of 6,500 gallons capacity is driven by two vertical engines, each 10 inches diameter by 12 inches stroke. The auxiliary circulating pump, 5 inches in diameter, is driven by a 6½-inch by 6-inch vertical engine.

The bilge and sanitary pumps, each 6 inches diameter by 25½ inches stroke, are connected to the main engine. The feed pumps are of the independent vertical simplex type, 12 inches by 8 inches by 24 inches. The fire and bilge pumps are independent vertical duplex, 12 inches by 7 inches by 12 inches, and the sanitary pump is independent vertical duplex, 7½ inches by 5 inches by 10 inches. The evaporator feed pump, refrigerator, circulator and fresh water pumps are all duplicates, of the horizontal duplex type, 4½ inches by 2¾ inches by 4 inches.

The auxiliaries include two 15 kilowatt generator sets, a No. 30 Reilly multicoil feed water heater, two 35-ton evaporators, a 1,000-gallon distiller, a 3-inch twin grease extractor and two metropolitan injectors.

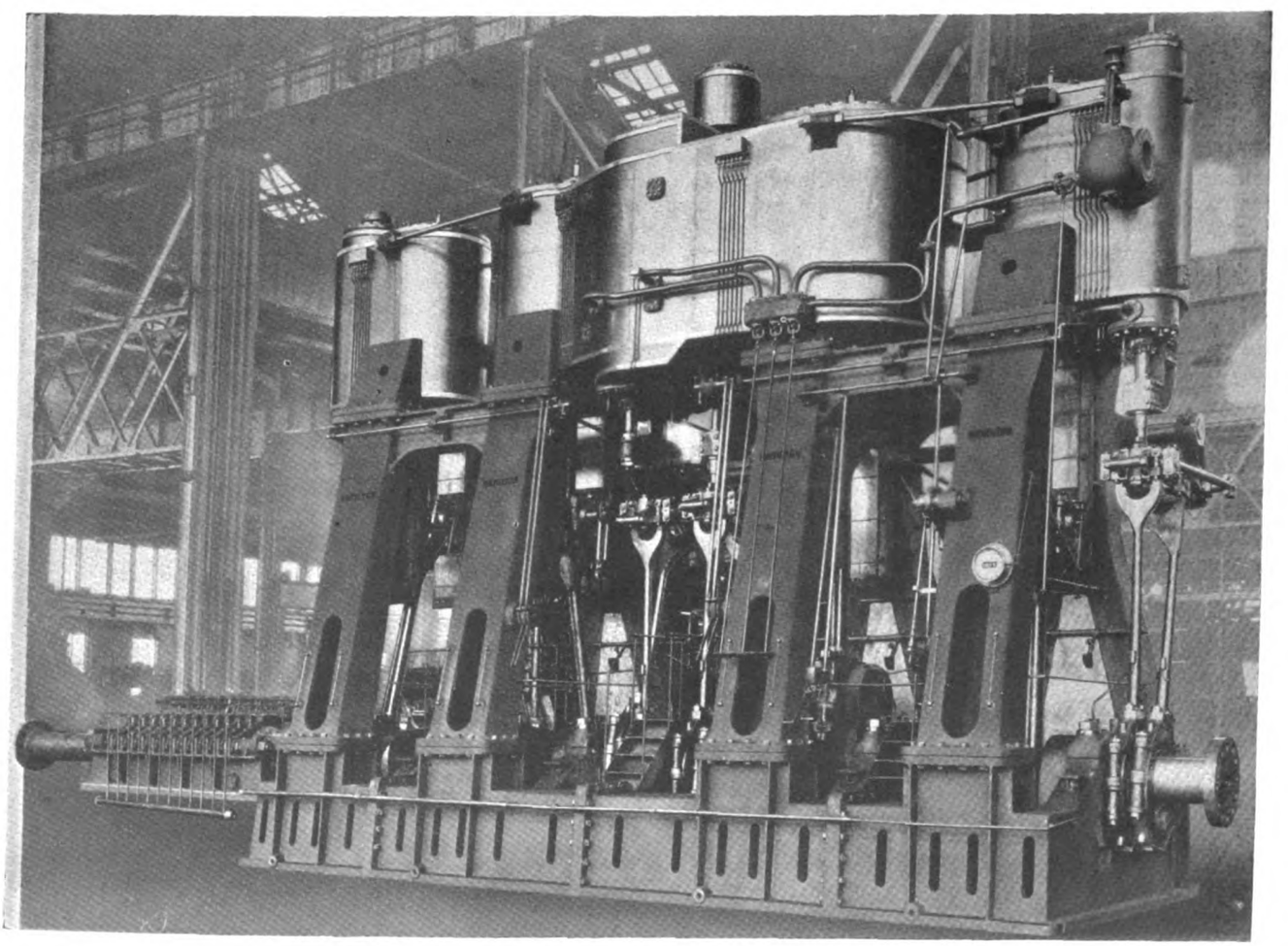
MAIN ENGINE

The cylinders of the main engine are 27½ inches, 40 inches, 59 inches and 86 inches diameter by 54 inches stroke. With a boiler pressure of 220 pounds per square inch the engine develops 4,200 indicated horsepower at 75 revolutions per minute.

The arrangement of the cylinders from forward to aft is as follows: High pressure, low pressure, second intermediate and first intermediate. The cranks are balanced on the Yarrow-Schlick-Tweedy system offsetting the angles from the usual 90 degrees. This arrangement of the cylinders simplifies the receiver piping, reducing condensation to a minimum.

The high pressure, first and second intermediate cylinders are fitted with piston valves, the low pressure cylinder with a balanced slide valve. All piston valves are fitted with plain balance pistons on top and the slide valve with a Lovekin balance piston to counteract the unbalanced weight and inertia of the valve gear parts. The valves take steam as follows: High pressure, first and second intermediate inside and low pressure outside.

The pistons for the high pressure and first intermediate cylinders are made of cast iron and for the second intermediate and low pressure cylinders of cast iron. The low and second intermediate cylinders are bolted together with the



Main Engine of the Tamaihua Erected in the Builders' Shop

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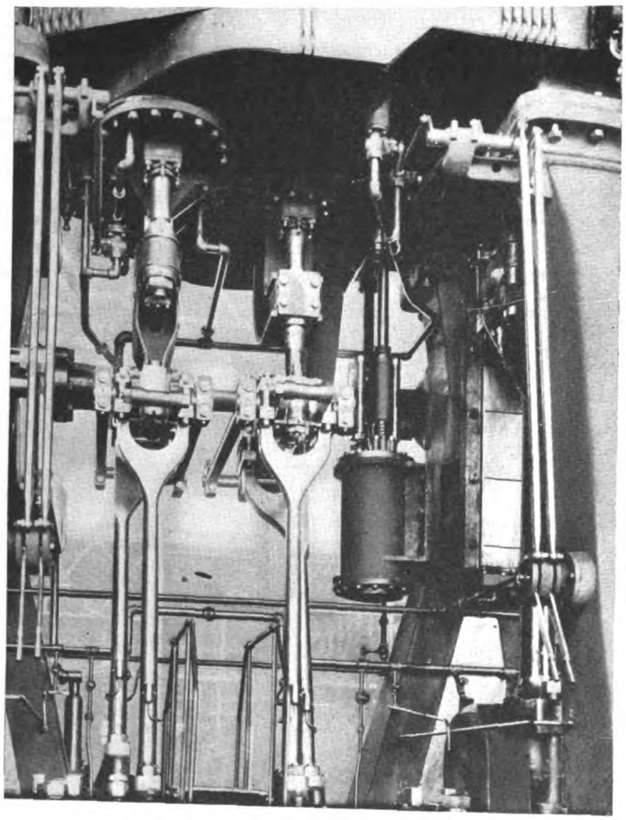
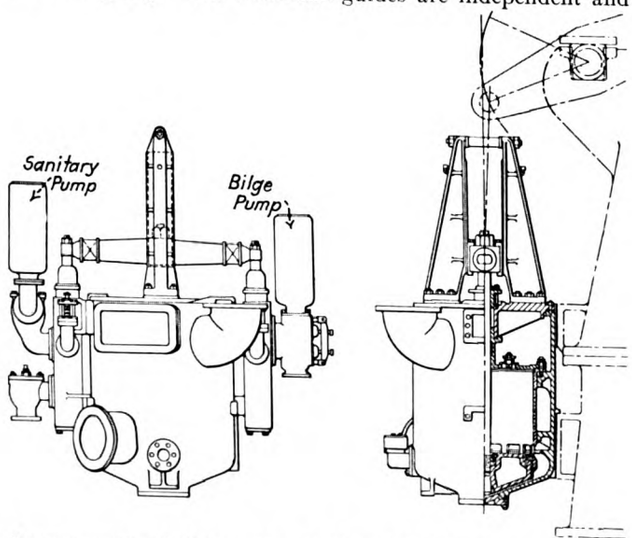


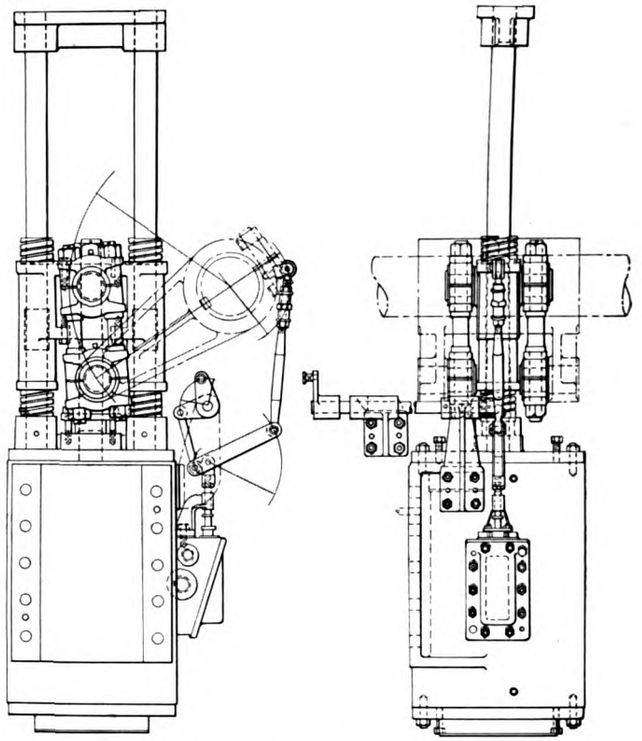
Arrangement of Reversing Engine

high pressure and first intermediate at either end and held by tie rods. This arrangement gives interchangeability to the crank shaft section, and eliminates outside receiver piping between the second intermediate and low pressure cylinders. The high pressure and first intermediate cylinder receiver pipes are made of copper fitted with expansion joints, which are provided with drain pockets for removing condensation.

The housings are box shaped, of cast iron, and arranged independent for each cylinder. The flanges for bolting to the bedplate and cylinders are liberally proportioned. Where the cylinders are independent, such as the high pressure and first intermediate, the housings are bolted together fore and aft for rigidity. The crosshead guides are independent and



Arrangement of Pumps Attached to Main Engine, Showing Half Section of Air Pump



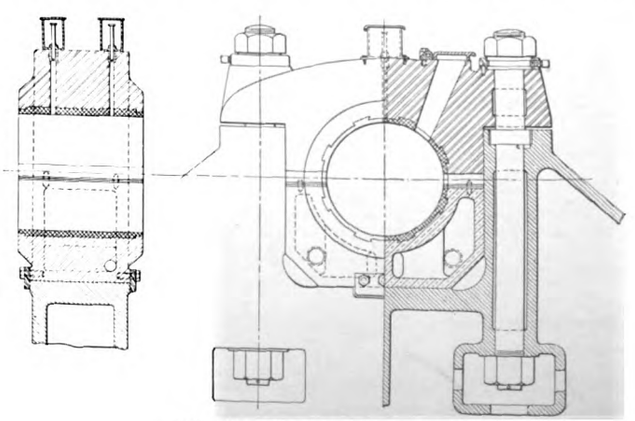
Front and Side Elevations of Reversing Engine, Showing Double Link Arrangement

bolted to the face of the housings; they are provided with water circulation. The bedplate is made of cast iron in four sections bolted together. Cross girders heavily ribbed provide recesses for the main bearings. The bottom of the bedplate is flat for bolting to the ship structure.

The air and bilge pumps are bolted to the second intermediate back housing and bedplate and are driven through a beam from the crosshead. The reverse engine, of the single ram type, is located on the aft side of the low pressure back housing. The turning engine, of the double cylinder type, is bolted to the forward side of the first intermediate back housing. The thrust is of the horseshoe type with bearings at each end; it rests on a separate casting, forming a foundation in line with the bedplate.

Construction Details

The crosshead construction is of the double slipper type with babbitted cast iron slippers bolted to the crosshead, the go-ahead side being on the back housing. The connecting rods are of the forked type with cast steel babbitted boxes on the crank end and bronze babbitted boxes for the crosshead



Details of Main Bearings

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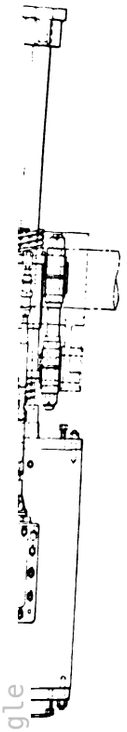


Showing

end, the usual provisions being made for providing taking up wear in all bearings.

The main bearing construction consists of a lower bronze babbitted box with cast steel babbitted cap, both fitted snugly into a recess on the bedplate. The lower box is cored for water circulation.

The crank shaft is built up in sections with the crank pins and shaft section shrunk onto the forged webs. The shaft is made in four interchangeable sections held together by reamed bolts.

Valve Gear

The valve gear is of the Stephenson link type. The eccentric sheaves are of cast iron in halves keyed to the shaft and held together by fitted bolts. The eccentric straps are of cast steel with babbitted face and fitted with shims for taking up wear. The eccentric rods have bronze boxes for attachment to the links. For "going ahead" the eccentric rods are arranged for "crossed rods," using long drag rods for connecting the links with the reverse shaft. The reverse shaft is located on the back of the engine and supported by babbitted bearings to the housings.

The reverse levers are of cast steel keyed to the shaft and fitted with slotted arrangement for adjusting cut-offs. The valve stems for the second intermediate cylinder, having two valves, are connected by a steel casting crosshead fitted with bronze liners operating on guides bolted to the cylinder.

Reverse Engine

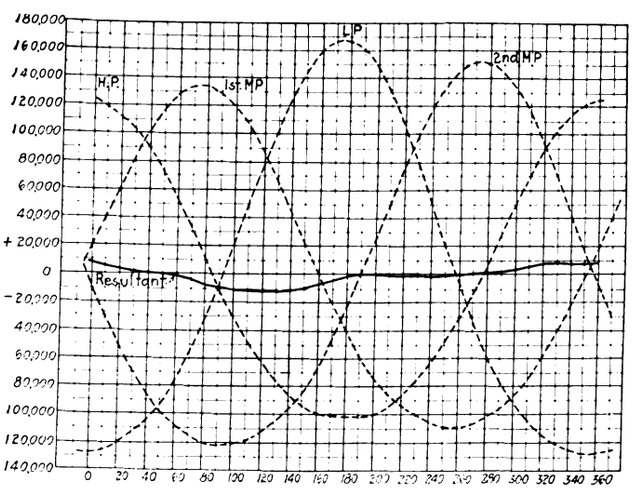
The reverse engine is of the single steam ram type, consisting of a steam cylinder operating an arm keyed to the reverse shaft.

The engine is bolted to the low pressure back housing. In order to avoid the usual long overhang, a scheme of bringing the cylinder close to the housing was evolved by a double link arrangement, and to absorb the extra thrust due to the short links a double guide bar was used. The follow up gear operating the slide valve is connected with the handling gear.

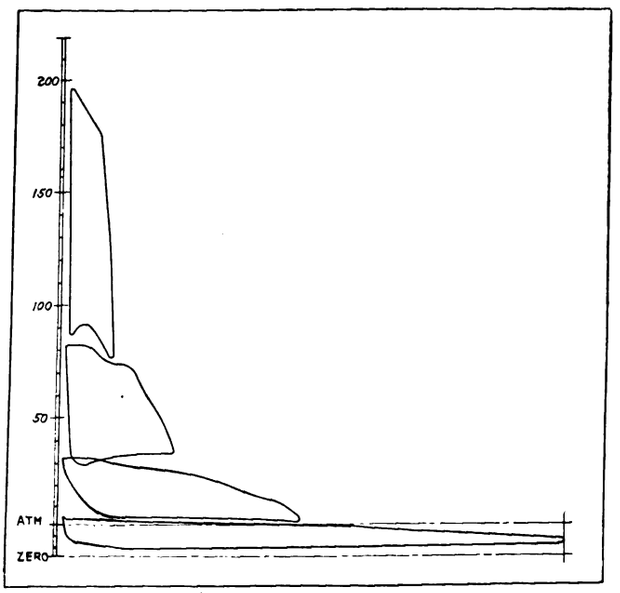
Attached Auxiliaries

The turning engine is of the double cylinder type fitted with Stephenson reverse links. It operates the main shaft through a double set of worm gearing. The disengaging is done by moving the worm out of gear with the wheel on the main shaft.

The air pump is of the Edwards single acting type driven from the main crosshead through beams. The pump body is of cast iron with removable bronze liner and cast iron bucket



Vertical Inertia Forces of Cylinder and Valve Gear Rotating and Reciprocating Parts



Combined Indicator Diagrams

with bronze follower. The valve deck is of bronze with valves of excelsior fibre. The valves are accessible through an inspection door on the side of the pump body. The bucket rod of steel is attached to a crosshead which is guided by vertical brackets bolted to the pump cover.

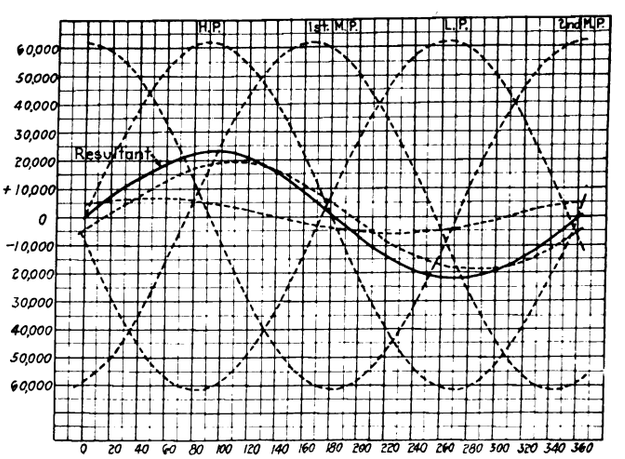
The bilge and sanitary pumps are bolted to the air pump, and the plungers are attached to the air pump crosshead. The bilge pump is fitted with leather clap valves and the sanitary pump with rubber valves. Air chambers and relief valves are provided as required for smooth operation and insurance against excessive pressures.

Handling and Operating Gears

The throttle valve is of the double beat balanced type fitted with Monel metal seats. For quick control a butterfly valve is placed in the valve body close to the high pressure cylinder.

The steam chests of all cylinders are connected with the throttle for live steam connections. Operating levers for the throttle, reverse and drains are located on the starboard side and centralized around the low pressure housing within easy reach of the operator.

The oil cups for reciprocating parts are located on the front side of the cylinders and connected to the proper bearings



Horizontal Forces of Cylinder and Valve Gear Rotating Parts

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through pipes. Small bearings are provided with cups for hand oiling and the main bearings with wick oilers

Water service from the sea is supplied for the shaft bearings, eccentrics and thrust shoes. The guides are water cooled, by connection to the sanitary system. Ample provision is made for protecting the operators against the moving parts by guards, rails and covers, and steps are fitted over the shaft at convenient places. The eccentrics operate in oil-tight pans. Relief valves are fitted to the top and bottom of all cylinders and on all valve chests. There is also a system of drain piping attached to the cylinders and chests connected to the condenser or feed water system. The drain valves are operated from the lower grating.

Balancing of the Engine

The engine was designed with the view of obtaining the best balance, without any sacrifice in weight or strength. The cranks were arranged on the Yarrow-Schlick-Tweedy system.

The curves (page 311) show the effect of both vertical and horizontal forces due to cylinder and valve gear reciprocating and rotating parts. The resultants are well within practical limits for smooth operation.

Detail Dimensions

The principal dimensions of detail parts of the engine are as follows:

Diameter of crank shaft .....16 inches
Diameter and length of main bearings ....16 by 17 inches
Diameter and length of crank pin .....16¼ by 16½ inches
Diameter and length of crosshead pin .... 8 by 9 inches
Length between centers of connecting rod .....120 inches
Diameter of connecting rod—top and bottom .....7 inches—8 inches
Length and width of crosshead slipper...30 by 18 inches
Diameter of high pressure piston valve—top and bottom .....12 inches—11½ inches
Diameter of first intermediate pressure piston valve—top and bottom .....21 inches—20½ inches
Diameter of second intermediate pressure piston valve—top and bottom (2).....21 inches—20½ inches
Diameter of piston rod .....7½ inches
Diameter of valve stem stuffing box—guides .....4½ inches—5 inches
Lineal clearance of cylinders—top and bottom .....½ inch—⅝ inch
Diameter of steam pipe .....10 inches
Diameter of exhaust pipe .....30 inches
Diameter and length of link block pin.....5 by 5½ inches
Diameter and width of eccentrics.....33 by 5¼ inches
Diameter and length of eccentric rod pin...4 by 4 inches
Diameter of eccentric rods—top and bottom .....35⅝ inches—45⅝ inches
Diameter and length of drag link pin.....3 by 3½ inches
Width and height of link bar .....2 by 6½ inches
Diameter and stroke of reverse engine.....16 by 25 inches
Diameter of reverse shaft .....8 inches
Diameter and stroke of turning engine, double .....6 by 6 by 6 inches
Diameter of thrust shaft .....16 inches
Diameter and number of collars of thrust shaft .....27 inches—12
Thickness of thrust collars .....2½ inches
Diameter and number of coupling bolts...2¾ inches—12

Trial Trip

On September 19, 1921, the trial trip was made and every part of the machinery worked successfully. A speed of 11.32 knots was obtained on a 28-foot draft with an indicated horsepower of 3,615 at 70 revolutions per minute.

Observations during the trial trip were as follows:

Steam boiler pressure .....218 pounds per square inch
Pressure in high pressure steam chest .192 pounds per square inch
Pressure in first intermediate pressure receiver ..... 86 pounds per square inch
Pressure in second intermediate pressure receiver .....31.5 pounds per square inch
Pressure in low pressure receiver... 5 pounds per square inch
Vacuum .....24 inches
Temperature of feed water, inlet .....122 degrees
Temperature of feed water, outlet...194 degrees
Back pressure in heater ..... 5 pounds per square inch
Temperature of inlet sea water.....55 degrees
Temperature of outlet sea water from condenser .....118 degrees
Temperature of condenser exhaust ...132 degrees
Temperature fuel oil to heater .....62 degrees
Temperature fuel oil from heater ....202 degrees
Pressure of fuel oil .....150 pounds per square inch
Pressure forced draft .....1¼ inches
Pressure forced draft at furnace....0.4 inch
Temperature of engine room .....81 degrees
Temperature of boiler room .....88 degrees

During the trial a check was made on the fuel consumption, which showed 11.8 barrels of oil per hour which is equivalent to 0.94 pound per indicated horsepower hour.

The builders' guarantees both as to speed and economy were fulfilled by liberal margins.

Maiden Voyage

The *Tamiahua* left San Francisco on September 29, 1921, on its maiden voyage through the Panama Canal to New Orleans. Great interest had been evidenced in this ship as it is the largest merchant vessel ever built on the Pacific Coast of the United States or in fact on the west coast of the Western Hemisphere. It also has the largest deadweight tonnage of any ship that ever sailed out of the port of San Francisco or into the ports of New Orleans and Galveston.

The voyage to Panama was uneventful as everything worked smoothly, the engine operating without vibration or any sign of heating of the bearings. The ship was water ballasted to 18 feet, mean draft, and maintained an average speed of 10½ knots, with the engine developing 2,725 indicated horsepower at 61.9 revolutions per minute. Sounding of the tanks indicated an oil consumption of 0.927 pound per indicated horsepower hour, with all oil consumed by the engine and auxiliaries charged to the main engine horsepower. Allowing for auxiliaries this gives 0.86 pound of oil per indicated horsepower hour used by the main engine alone.

From Panama the ship proceeded to New Orleans under an average speed of 11 knots with the engine developing 3,100 indicated horsepower at 65.9 revolutions per minute. The fuel consumption from sounding indicated 0.96 pound of oil per indicated horsepower hour with all oil used charged to the main engine or 0.89 pound deducting for auxiliaries. The oil used was 18.9 Baume gravity.

The vessel recently made a voyage from Port Lobos, Mexico, to Philadelphia and delivered at the latter port 115,092 barrels of 20 gravity oil. The distance covered on the voyage was 2,010 nautical miles with the main engine averaging 65 revolutions per minute and indicating 3,255 horsepower, including auxiliaries. The fuel consumption per indicated horsepower hour, including auxiliaries, amounted to 0.948 pound. The oil used was Mexican crude of 12 Baume gravity with a caloric value of 17,400 British thermal units. The total oil consumption per day was 33.07 tons and the average speed 10.63 knots.

Shipping Board to Open Freight Offices in Middle West.—In accordance with plans which have been under consideration for some time, the Shipping Board Emergency Fleet Corporation will open shortly a series of freight offices at Cincinnati, Memphis, Kansas City, Chicago, Detroit and Minneapolis, which will report to a manager of interior offices with headquarters in Washington. The managers of these interior offices are to work for the development of the American merchant marine by keeping in touch with local business organizations and with possible shipments, but will not themselves pick cargoes.

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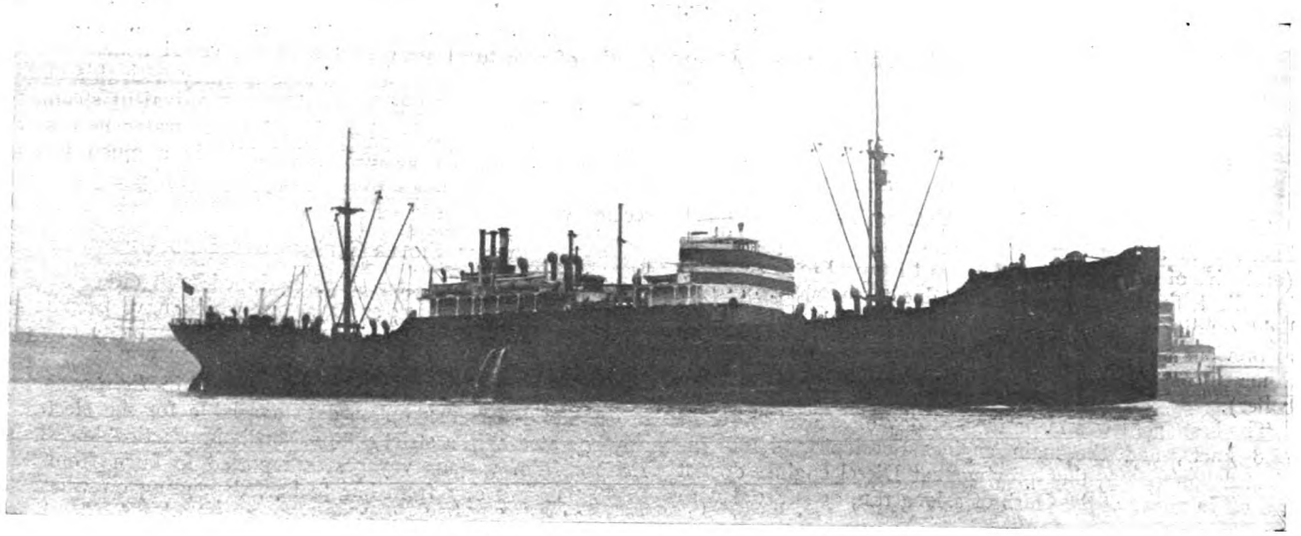

Twin Screw American Motorship William Penn

William Penn Completes Voyage Around the World

Motorship Demonstrates Reliability of Diesel Engine—Striking Fuel Economies Recorded for Main and Auxiliary Machinery

THE *William Penn* has the distinction of being the first large American motorship suitable for the deep sea cargo trade. She is owned by the Shipping Board and operated by the Barber Steamship Lines.

On March 19 she completed her maiden voyage around the world of 28,500 miles, and has completely demonstrated the reliability of the Diesel drive and the great economic superiority of the motorship over the steam-driven vessel.

On her arrival back in New York, the propelling machinery was found to be in perfect condition, with no expenditures whatsoever required for repairs. The exhaust and inlet valves of the main engines were changed only once which was at the middle of the voyage. All work on the main engines, which was of a routine nature, was done by the engineer personnel when in port, and all similar work on the auxiliary engines and machinery was done while under way, at sea. The auxiliary engines worked perfectly throughout the trip, and were run at times over 500 hours without stopping. There was no involuntary stopping of the vessel at any time throughout the voyage.

The motorship *William Penn* is 455 feet overall, 445 feet between perpendiculars, and 60 feet beam, with a designed draft of 28 feet, 4¾ inches, loaded, corresponding to 12,375 tons deadweight, and 17,100 tons displacement. The description of the machinery has been given previously and is the same as is being installed by the Cramp Company in the American-Hawaiian Steamship Company's motorships *California* and *Missourian*.

The main engines are six-cylinder, having a diameter of 29⅛ inches by 45¼ inches stroke, and originally designed for 4,500 indicated horsepower for the two engines, when turning at 115 revolutions per minute. Due to the full form of the *William Penn* the power was reduced by reducing the revolutions to 108, corresponding to the power of 4,200 indicated horsepower required for the 11.5 knots, and thus keeping the mean indicated pressure up to the same as originally designed.

There are, in addition, three auxiliary Diesel engines, each direct coupled to 65 kilowatt generators, for supplying current to the various electric driven engine room and deck machinery. At sea, one of the auxiliary engines was all that was required, with about a 55 kilowatt load carried, which included that required for coffee urns, electric hot plate, etc.

Starts Voyage Around the World

The *William Penn* left New York on September 3, 1921, stopping at Savannah to complete loading. The loading at New York consisted of case oil and barrelled grease, taken on at the Tidewater Oil Company's pier, and miscellaneous cargo put aboard at the pier of the Barber Steamship Lines, in Brooklyn. In Savannah, cotton and barrelled resin were loaded, the latter being placed on deck. She then sailed to the Far East, via Panama and Honolulu, at which latter place about 200 tons more fuel oil was put on to fill the tanks, so that it would not be necessary to purchase any additional oil at the higher prices prevailing in foreign ports.

The first stop to discharge cargo was at Yokohama, and the first severe storm was encountered between the 180 degree meridian and Yokohama, when it was necessary to slow down to prevent losing the deck cargo.

The vessel then proceeded in succession to Kobe, Shanghai, Foochow, Swatow, Hong Kong and Manila. At the latter named place unloading was completed and loading commenced for the return voyage. The next stop was at Cebu, Philippine Islands, and then passing between Celebes and Borneo, she stopped at Surabaya, Java, where Christmas was spent, 8 degrees below the equator. The next port was Singapore, Straits Settlements, where loading was completed for the return trip. The next stop was at Suez. After passing through the Suez Canal, she arrived at Port Said, where a small amount of cargo was taken out. The remainder of the cargo was discharged in turn at Marseilles, London, Rotterdam and Liverpool. From the latter place the vessel sailed on March 6 for New York, in ballast, arriving on the afternoon of the 19th, after having experienced some very severe gales in the North Atlantic, the wind at times attaining a velocity of 110 miles per hour.

On the return trip the vessel was not fully loaded, although the cargo was of very bulky nature, consisting of hemp, copra, rattans, tapioca, coffee, etc.

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The total time required for the voyage, counting 24 hours to the day, was 197 days. The total number of days in port was 86, and the total time at sea was 108 days. About 3 days were taken up in passing through the two canals at reduced speed, up rivers, etc., from pilot boats to piers, and standbys at pilot boats, etc.

Fuel Consumption

The mean sea speed from New York to London was 11.01 knots, with a mean consumption of 13.06 tons per diem, (exclusive of donkey boiler). From Liverpool to New York, in ballast, the speed was reduced, due to the ship being in light condition, and to the very severe storms encountered, as previously mentioned, the vessel averaging 8.9 knots, with a mean consumption of 13.15 tons, (exclusive of donkey boiler).

The best speed was made the last day of her voyage, with 12.8 knots, and the main engines developing 4,700 indicated horsepower, thus proving that Diesel engines do not fall off in power at the finish of a long run, as is usual with the steam plant. Compression cards were taken at this time, which showed that compression was normal in all cylinders.

The longest non-stop run was from Singapore to Suez, or 4,943 nautical miles, taking nearly eighteen days, with a mean sea speed of 11.48 knots, and mean total consumption of main and auxiliary engines of 13.41 tons per day. The consumption per indicated horsepower, main engines only, and all purposes, was 0.3025 pound. The mean indicated horsepower taken when leaving Singapore was 4,130 and revolutions per minute 107.9, on a draft of 21 feet 8 inches.

On leaving Savannah the draft was 26 feet 5 inches and the mean sea speed from Savannah to Panama was 11.6 knots, with a consumption per 24 hours of 13.81 tons, and a consumption per indicated horsepower, main engines, all purposes, of 0.3055 pound.

Consumption for Auxiliaries

In port, when loading or unloading, with two or three auxiliary engines in operation during the day, and one engine running for the 24 hours, the consumption for the auxiliary engines was about 150 gallons per day, or 0.48 ton, which is from one-tenth to one-twentieth that for an equivalent steamer. When one engine was operated for the 24 hours, without winches in operation (as over holidays), the consumption was about 110 gallons per day. The consumption of the one auxiliary engine at sea was 120 gallons, or 0.36 ton. The donkey boiler takes from 160 to 170 gallons per day, or 0.52 to 0.55 ton, when in use.

The total consumption for the voyage was 1,475 tons. It is estimated for a steamer the consumption would have been 4,800 tons for the same trip, and it would have been necessary to have purchased 3,000 tons of oil abroad. It is figured that the motorship saved in cost of fuel alone from $60,000 to $70,000. On the outward voyage the deep tank was available for cargo, giving about 5 percent greater carrying capacity than that of the equivalent sister ships. The lowest fuel consumption recorded was from Honolulu to Yokohama, with 0.29 pound of oil per indicated horsepower, main engines, all purposes.

The lubricating oil required when at sea, for the whole plant, including main engines and auxiliary engines, averaged 15 gallons per day, for the voyage.

Considerable bad weather was encountered during the voyage, due to the time of the year. In addition to the storm in the Northern Pacific, after passing the 180th meridian, the *Penn* passed through a typhoon on the way from Hong Kong to Manila, and met very heavy weather and head winds for four days from Port Said to Marseilles. Of the total of 108 days at sea, 24 were stormy.

The *William Penn* sailed on April 22 for the Far East again, carrying chiefly heavy or deadweight cargo, consisting mostly of structural steel, and with the vessel loaded down to the full draft marks. She is able to carry with this class of cargo about 1,000 tons more than an equivalent steamer, representing the additional fuel and fresh water necessary to be carried by the steamer. Accordingly a much better showing should be made over the equivalent steamer on the second voyage.

Several Sister Steamships Laid Up

There are several sister ships equipped with either steam turbines or reciprocating engines, but which have been laid up for the past year or more, due to their inability to run at a profit.

A comparison with the electric driven ship *Eclipse* is in order, but due to incomplete data available for the electrically operated ship a strict comparison is impracticable. The *Eclipse* from various voyages is reported to burn from 32 to 40 tons per day from bar to bar, depending on whether 19 or 24 nozzles on the turbines are open, and corresponding to speeds from about 9 to 10 knots. This works out at about 14.9 tons per 100 miles. The consumption per 100 miles for the motorship *William Penn* from bar to bar works out at 4.87 tons from Singapore to Suez, and 4.94 tons from New York to London. The *William Penn* burns only a small fraction of that of the *Eclipse* in port but which does not appear in the above comparison.

	M/S Wm. Penn	S/S Eclipse
Length between perpendiculars, feet	445	440
Beam, feet	60	56
Depth to shelter deck, feet	36.67	38
Draft, loaded, feet	28.39	28.58
Displacement, loaded, tons	17,100	15,700
Deadweight, tons	12,375	11,867
Cargo, cubic feet, grain	627,830	589,355
Cargo, cubic feet, bales	593,910	552,969
Designed speed, knots	11.5	11
Designed revolutions per minute	108	100
Designed power	4,200IHP	3,000SHP

It will be seen from the above that the hull conditions are much more favorable for the *Eclipse* than for the *William Penn*, due to smaller displacement and finer lines of the former. The *William Penn* is being operated very close to her limiting speed, while the *Eclipse* is considerably under hers. With the *William Penn's* engines in the *Eclipse's* hull a better showing would have been made for the motorship.

Although America has been backward compared with other countries, in adopting the large motorship for the deep sea trade, it is hoped that the *William Penn* has showed the way and that there will soon be laid down a large number of motorships, which are so vital in the maintaining of the American flag on the sea.

The American-Hawaiian Company will soon have in commission two vessels of similar size to the *William Penn*, namely, the motorships *Californian* and *Missourian*. Due to their finer lines they should make a half knot better speed than the *William Penn* with their main engines developing their normal rated indicated horsepower of 4,500.

Differential Between American and British Ships.—A ship of the *George Washington* type would cost in the United States about $9,500,000. She could be built in England for about $7,500,000 to $8,000,000. The American owner of an American built *George Washington* would therefore have to carry, during the life of the ship, an excess capital cost of $1,500,000 to $2,000,000 on which he would be paying probably $250,000 to $300,000 per year more than a British owner of a similar ship. The payroll of this ship would be not less than $450,000 per year, and would involve a wage differential of nearly $100,000. The higher cost of repairs and of the American administrative staff would add to this another $25,000 making a total annual differential against this ship of approximately $400,000.

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Electric Auxiliaries on Merchant Ships*

Motors for Deck and Engine Room Auxiliaries — Direct vs. Alternating Current—Wiring and Installation—Operation

By Edgar D. Dickinson†

BECAUSE electricity makes possible many reductions in the cost of operation and at the same time enhances the earning power of a ship, it is being used to an ever-increasing extent for driving the machinery on ships. On highly efficient new ships, especially motorships, practically all the auxiliaries are driven by electric motors. In the motorship Diesel engines are employed to drive the generators. On a steamship, however, the most generally accepted practice is to install turbine-driven generator sets for auxiliary power.

Auxiliary machinery on ships can be readily subdivided into two broad types: (*a*) For deck use; (*b*) for below-deck use. The motors most suitable are enclosed, weather-proof for above deck, and ventilated for below deck.

Deck Machinery

Electric deck machinery has been developed along two fundamentally distinct lines: one in which the motor is mechanically geared to the drums, and the other where some form of hydraulic speed reducing gear is fitted between motor and drum. The latter class seems to have found considerable favor abroad, where certain well-known manufacturers have developed winches, using either the Williams-Jenney or Hele-Shaw hydraulic power transmission. Electric hydraulic power transmission is particularly well adapted for steering gear work and has been developed in this country. For general winch service the hydraulic pump and motor are excessively costly.

For gear winches the series motor or compound-wound with very small amount of shunt winding is the most desirable.

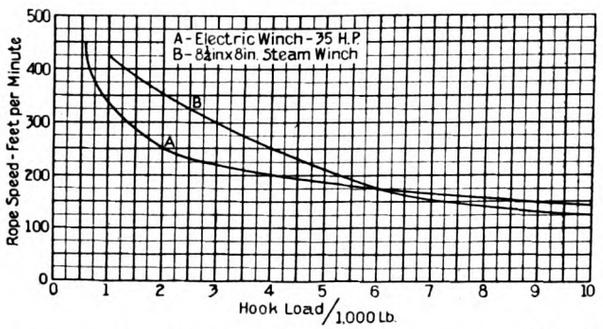

Fig. 1.—Characteristic Curves of Electric and Steam Winches

Fig. 1 shows how the natural characteristics of the series motor make it most suitable for winch service. It is found necessary to throttle the steam winch at light loads to reduce the speed. In practice, therefore, it approaches more nearly the speed of the electric winch. Many winches are fitted with winch heads. When handling cargo with these instead of the drum the revolutions per minute will run up somewhat. However, the winch head being of smaller diameter than the drum, it is generally found that the rope speed on the winch head will be about right.

For all service using hydraulic gear, constant-speed motors are used, either alternating-current or direct-current.

Of all the electric apparatus aboard a ship the winch is subject to the most abuse. Everything about it, therefore, should be designed, manufactured and installed in the most substantial and workmanlike manner.

Specifications for Electric Deck Machinery

Specifications for electric deck machinery should cover the following:

1. Insulation should be as highly moisture-resisting as it is possible to get by the use and treatment of the best materials. This applies not only to windings but to all bushings, brush holder collars, etc., which, if hygroscopic, are liable to result in grounds.

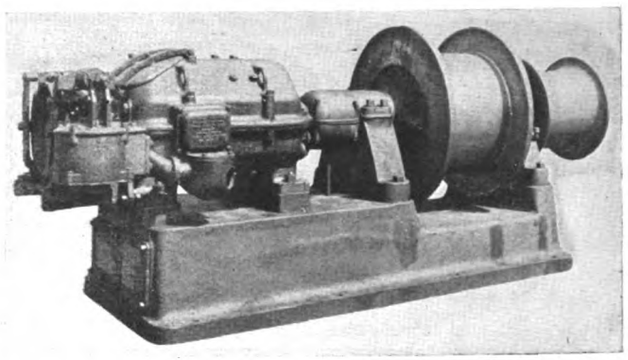

Fig. 2.—New Type of Electric Cargo Winch Having the Reduction Gear Inside the Drum

2. Motor frames should be thoroughly cleaned and painted on the inside to prevent, as far as possible, scale forming by corrosion.

3. Covers for inspection openings should preferably be hinged and arranged so as to clamp tightly. On all apparatus, motors, resistor boxes, controllers, etc., if impracticable to hinge the covers they should be attached by swinging bolts. Cap screws or cap bolts should not be used, as they are liable to be dropped into the motor or left on deck and lost.

4. Bearings should be designed to prevent, as far as possible, ingress of water and egress of oil due to rolling of the ship.

5. All apparatus should be provided with some form of drain. It must be recognized that, while machinery may be built in the factory so watertight that it can be submerged, there is no assurance that this condition will exist after it has been once opened on deck. Further, any totally enclosed electrical apparatus is liable to breathe under varying temperatures which may result in an accumulation of moisture by condensation.

The cost of good electrically fitted machinery installed should be little, if any, more than that of high-grade steam machinery. The insulation in a marine motor must be moisture resisting to the maximum practical extent; otherwise, it should not be deemed proper for the service.

Fig. 2 shows a deck winch developed in this country, several of which type will shortly be installed on ships. This winch is a radical departure from the generally recognized designs using either spur or worm gearing.

Electric steering gears have been developed for mechanical

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control of the rudder. For these the service is extremely intermittent, operating from two to ten times per minute, which means that the motor would be started, stopped and reversed thousands of times during one voyage. Such gears require the installation of a motor of sufficient torque to swing the rudder to the extreme angle, whereas during most of the time a very small amount of power is required. This means loss in efficiency as the motor is operating nearly all the time very much underloaded.

For controlling the steering gear from the pilot house two electrical means are available—follow-up and nonfollow-up. The first entails considerably more wiring, a multiple switch in the wheel house, a more complicated control in the steering engine compartment, and has the disadvantage of moving the rudder step by step a definite number of degrees. By the nonfollow-up means the rudder can be moved by fractions of degrees in either direction; its use, however, calls for the installation of a rudder indicator in the wheel house. A device has been worked out to show positively the position of the rudder at any instant, using simple means already developed.

Special Deck Machinery

The following is a table of deck machinery which, with slight modification, would be applicable to ships of any tonnage between 8,000 and 10,000 tons deadweight. It should be borne in mind that the size of the cargo winches is based upon the best practice for general cargo and therefore does not vary greatly with the size of the ship. The number of winches, however, has to be modified to suit the number of hatches and derrick booms of the different ships.

	No. units	Assumed motor horsepower	Duty
Anchor windlass..	1	70	Very intermittent, severe. Often submerged. May be stalled in operation.
Cargo winches....	12	35	Intermittent. Fast cycle, severe duty. Sometimes submerged. Wide range in loads and speeds.
Steering gear.....	1	35	Seldom fully loaded. Severe intermittent duty with mechanical gear. Moderate continuous duty with hydraulic gear.

Types Developed (Electric Deck Machinery)

	Drive	Motor	Speed control
Anchor windlass and capstan....	Spur gear....	Reversing	Electric.
	Worm gear...	Reversing	Electric.
	Hydraulic ...	Constant speed.	Hydraulic.
Cargo winch...	Worm gear. Spur gear..	Reversing	Electric with electric brake (general use).
		Reversing	Electric with mechanical brake.
		Constant speed.	Mechanical brake and clutch (free drum winch).
		Constant speed.	Mechanical brake hoisting and lowering clutches.
		Constant speed.	Reverse gear and brake. No speed control (winch head only).
	Hydraulic ...	Constant speed.	Hydraulic.
Steering gear.....	Spur gear....	Reversing	Electric.
	Worm gear...	Reversing	Remote.
	Hydraulic ...	Constant speed.	Hydraulic.

Below-Deck Machinery

It should not be necessary to emphasize the importance of fitting equipment of proper design and of the highest grade material, particularly pumps vital to the operation of the ship and which must be relied upon to operate continuously day and night for weeks at a stretch.

The greater part of the electrical machinery below deck is naturally located in the engineroom. The following table gives a list of below-deck auxiliaries suitable for a cargo ship of about 8,000 to 10,000 deadweight tons and equipped with 2,500 to 3,000 shaft horsepower steam turbine. A motorship requires somewhat fewer auxiliaries, and slightly less power is necessary for driving them. Tankers require a number of motor-driven pumps for discharging the cargo. These may be installed either in a special pump room or arranged with the motors on deck with vertical shafts to the pumps below. It will be noted that in the list there are only five sizes of motors. That is with the intent of simplification and to reduce the number of spare parts to be carried. A study of particular cases may show that it is possible to satisfactorily arrange the engine-room equipment so as to have still fewer sizes.

Below-Deck Auxiliaries

	No. units	Assumed motor rating in horsepower	Duty
Propulsion:			
1. Circulating pump	1	40	Continuous at sea.
2. Boiler feed.....	2	25	One continuous at sea.
3. Forced draft fan.	1	20	Continuous at sea.
4. Condensate	1	5	Continuous at sea.
5. Lubricating oil...	2	5	One continuous at sea.
6. Oil cooler water..	1	5	Continuous at sea.
7. Fuel oil.....	2	5	One continuous at sea.
8. Fuel oil trans....	1	5	Intermittent (assume 4 hours per day).
Service:			
9. Fire and bilge...	1	10	Intermittent (assume 6 hours per day).
10. General service..	1	10	Intermittent (assume 6 hours per day).
11. Sanitary	1	5	Intermittent (assume 12 hours per day).
12. Fresh water.....	1	5	Intermittent (assume 2 hours per day).
13. Refrigerating ...	2	5	One continuous at sea.
14. Evaporator	1	5	Intermittent (assume 3 hours per day).
15. Ballast	1	10	Intermittent (assume 4 hours per day).
16. Workshop	1	5	
17. Oil purifier.....	1	5	
18. Galley	1	5	

Motors for these auxiliaries should be designed for continuous running, because, while certain pumps may be started and stopped frequently, the service cannot be considered intermittent.

In the engine room, and in fact even if placed in the lowest part of the ship, totally enclosed motors are not recommended. For continuous operation they would have to be excessively large. With the changes in the atmosphere that take place below the waterline, enclosed motors would be more liable to sweat and accumulate moisture internally than if well ventilated. In general, enclosed self-ventilated motors are recommended for the reason that they are often located in congested places where, if open, they would be

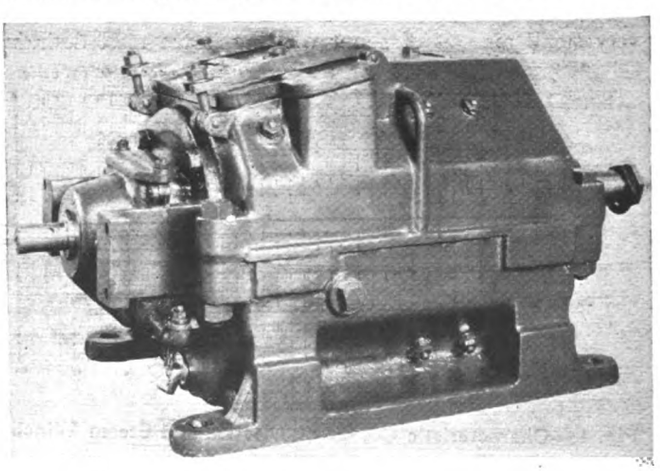

Fig. 3.—Direct Current Motor, Enclosed for Operating Deck Machinery

liable to mechanical injury and in addition would have to be protected from dripping water. However, as electrical machinery, when open, is more readily inspected and kept clean, it is not essential that the motors be enclosed if located, *e. g.*, on a gallery and properly protected from dripping water. Such motors should be screened to prevent rats eating the insulation. On tankers, if the cargo pump motors are of the direct current type and are located in a special pump room, they must be provided with some means of ventilation which will insure all explosive gases being driven off before the motors are started.

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The motors in the engine room should be insulated with the same care and the castings as thoroughly cleaned and painted as the motors on deck. The insulation on all marine electrical apparatus should be made as highly moisture-resisting as possible.

As illustrating the adaptability of electrical apparatus, the writer recently saw a report from a chief engineer which

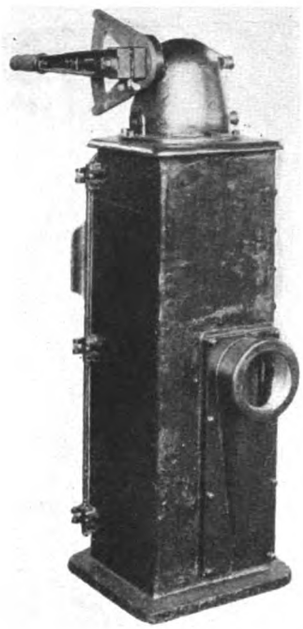

Fig. 4.—Controller for Deck Machinery Motors

stated that when the steam engines on his circulating pump and dry vacuum pump broke down he replaced them by two deck winch motors. The drive was so satisfactory that he intended to recommend that it be made permanent, and incidentally the ship burned 1½ tons of fuel oil per day less after the change.

Control

It would seem desirable that the means for starting and stopping each motor be located directly adjacent to it. Such starters are relatively inexpensive. They should be very substantial and moisture-resisting. Thin sheet iron should not be used, especially on any part of the construction which cannot be readily painted, as after a short time it is liable to rust and may be the cause of serious trouble.

On steamships the motors on the circulating pump, lubricating oil pump, boiler feed pump, hot well pump, balancer set or lighting motor-generator set, if any, and steering gear, should be fitted with starters, so that when power is restored after an interruption these particular motors will immediately start up automatically. The other motors can be restarted by the engineer at his convenience.

Generating Units

A study of the installations on a number of cargo ships of various tonnages indicates that on a steamship 150 kilowatts would give ample power for the deck machinery when in port and for the entire engine-room equipment when at sea. On a motorship about 75 kilowatts are necessary at sea. Therefore, on cargo ships of about 10,000 deadweight tons, two 150 kilowatt steam turbines or on the motorships three 75 kilowatt generator sets would give ample power with one unit for a standby at all times. The auxiliary power in many cases will be much greater than 150 kilowatts on refrigerator ships and on ships fitted in part for passenger service. The larger the amount of auxiliary power the greater the reason for highly efficient auxiliary turbines. Some studies have shown requirements for auxiliary power as great as 1,500 kilowatts.

Small steam turbines should be rugged and simple, as they will be classed as part of the propelling machinery and therefore vital to the safety of a ship. In sizes of 150 kilowatts and even smaller, gear reduction would be recommended, as the best direct current generator operation cannot be expected at the speed at which the turbine should run in order to get good economy. It is expected that these sets will be more substantial and rugged than sets of similar capacity for land service, where they are at all times readily accessible.

For the reason that on shipboard there is always possibility of scale or salt passing to the turbine from the boilers, it is preferable for the governor to control the speed by means of an oil Servo motor. All parts should be readily accessible. Even with the greatest care there is always liability that the lubrication may be momentarily interrupted, and as the bearings should be examined before the machinery is placed in service they should all be readily removable for inspection. An overspeed or emergency governor of the simplest and most reliable type should be fitted. Very specific and simple instructions should be issued to show the operating engineer the necessity of testing the governing mechanism periodically and assuring himself that it is in perfect operating condition.

The Most Suitable Electric Power

All references indicate that at the present time direct current is being generally adopted for auxiliary power on merchant ships. Some time ago there was considerable discussion as to the relative merits of alternating current and direct current. The following tabulation will show why direct current is being used to the greater extent:

Cargo Ships

Direct Current

Arguments For	*Arguments Against*
1. Simple wiring. 2. Any speed control easily obtained. 3. Equally suitable for continuous and intermittent duty.	1. Commutators require some attention.

Alternating Current

1. Lower cost of motors and generators. 2. Absence of commutators.	1. Wiring more expensive 2. Unsuitable for variable speeds necessitating hydraulic or other gear for winches and windlasses.

Tankers

Direct Current

1. Simple wiring. 2. Equally suitable for continuous and intermittent duty. 3. Speed of cargo pump can be varied to suit pressures and most efficient rate.	1. Commutators require some attention. 2. Little necessity for variable speed motors. Special cases could be fitted with hydraulic or direct-current power furnished from small motor-generator set. 3. Special precautions must be taken to ventilate motors in tank room.

Alternating Current

1. Lower cost of motors and generators. 2. Absence of commutators, particularly desirable in pump room. 3. Cargo handled by constant speed pumps.	1. Wiring more expensive. 2. Special motors necessary to change speed.

It would seem that for cargo ships direct current can be used to the greatest advantage. On tankers this is not so apparent.

Except in the smaller ships, it is desirable to use not less than 230 volts. The lower voltage necessitates large or more expensive control; also the cost of wiring and switches is greater.

For lighting, the arguments seem to be in favor of 115 volts. This necessitates the installation of a small 115/230-volt motor-generator set. The use of incandescent lamps for 230 volts is not recommended.

Wiring and Installation

It is impossible to speak too forcibly on this subject. A

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great deal of the criticism of electrical apparatus when thoroughly investigated has been found to be directly due to faulty, careless, slipshod methods of wiring and installation. Care and attention have been given to choosing apparatus, but the method of installation, the kind of wire, and many details of vital importance have been left to the wiremen's discretion with the inevitable result.

It is not the intention here to suggest that definite rules be laid down. Each engineer must work out his own particular problems. Certain underlying fundamentals, however, can generally be applied. The following are recommended:

That the wiring and distribution in the engine room be made as simple as possible, with relatively few circuits.

The switchboard should be largely a distribution panel designed with the idea of attaining maximum simplicity and occupying the least amount of engine-room space.

Circuits may be led from this distribution panel to different parts of the ship where they may be further subdivided,

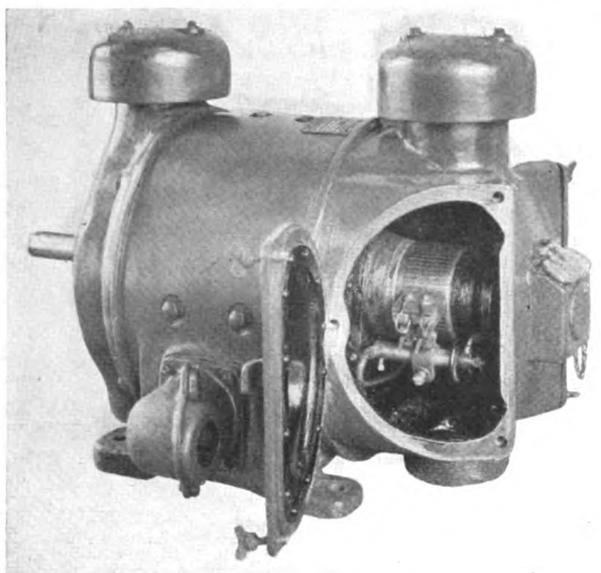

Fig. 5.—Direct Current Motor, Enclosed, Ventilated for Operating Below-Deck Machinery

as *e. g.*, five circuits for deck machinery, No. 1 to the steering engine, No. 2 to the after hatches, No. 3 to the forward hatches, No. 4 to anchor windlasses and forward capstans, No. 5 to after capstans. This will permit opening all the winch circuits when at sea and also allow for thorough inspection and try-out of the capstans, anchor windlass or steering engine when in port, even if cargo is being handled.

In the engine room a similar method may be applied, one circuit to the engine-room auxiliaries, port side, and another to the starboard side. By such simplification it will be possible to obtain low cost with maximum reliability.

Cables should not be run in conduits except, perhaps, for very short lengths where necessary for mechanical protection. Cables in the engine room should be run overhead. All cables should be thoroughly anchored so that the covering will not be chafed, due to vibration.

Operation

To study the relative merits of ships' auxiliaries, it is necessary to consider the part which they play in the economic operation of the ship.

It is not possible to make any exact general statement as to the proportions of the various items constituting the cost of operating merchant ships. They may, however, be listed as follows:

1. Fuel and lubricating oil at sea and in port.
2. Port charges including wharfage, lighterage, pilot fees, canal dues, stevedoring, tugboat charges, etc.
3. Salaries and subsistence.
4. Upkeep and repairs, deck department.
5. Upkeep and repairs, engine department.
6. Supplies, engine, deck and steward's departments.
7. Insurance
8. Loss and damage.

If we assume a 7,800 deadweight-ton ship fitted with 2,500 horsepower steam turbine on a schedule for coastwise service between New York and Seattle, stopping at San Pedro to load and discharge cargo and making four round trips per year, the charges might be approximately as follows:

Operating Disbursements

	Loaded both ways	Percentage	Loaded going, one-half loaded returning
1. Fuel	$81,300	14.8	$81,300
2. Port charge	290,420	52.9	211,020
3. Salaries	60,490	11.0	60,490
4. Repairs, deck	10,000	1.8	10,000
5. Repairs, engine	20,000	3.7	20,000
6. Supplies	20,250	3.7	20,250
7. Insurance	62,400	11.4	62,400
8. Loss and damage	3,650	.7	3,650
Total	$548,510	100	$469,110

Many of these would be affected by electrification of auxiliaries, and the net reduction would be very considerable.

1. *Fuel, etc.*—In the usual marine geared turbine installation with steam auxiliaries, the pressures generally carried are as follows:

	Gage
Boiler pressure	210 pounds.
Turbine bowl	200 pounds.
Auxiliary steam line	100 pounds.
Auxiliary exhaust	10 pounds.
Superheat	75 degrees F.

The auxiliary exhaust steam is used to heat the feed water, and that which is in excess of feed water heater requirements is by-passed to the main condenser.

Under full power, a fair operating average for this type of installation is as follows:

Steam Consumption per Hour:

	Pounds
Main turbine, 2,500 horsepower	28,875
Steam auxiliaries at sea	12,500
Total steam consumption	41,375

Steam per Shaft Horsepower Hour, all Purposes:

$$\frac{41,375}{2,500} = 16.5 \text{ pounds.}$$

Boiler Evaporation.—With watertube boilers, Howden draft system, feed water delivered to boilers at 220 degrees, 210 pounds gage pressure and 75 degrees superheat, a conservative estimate of the actual evaporation per pound of fuel oil is taken at 13.5 pounds.

Fuel Consumption:

$$\text{Fuel per hour} = \frac{41,375}{13.5} = 3,065 \text{ pounds} = 9.6 \text{ barrels.}$$

Fuel per day, 73,560 pounds = 32.8 tons
Fuel in barrels per day = 230

Fuel per Shaft Horsepower Hour:

$$\frac{3,065}{2,500} = 1.23 \text{ pounds.}$$

Fuel in Barrels, per Knot:

Assuming a speed of 10.5 knots, $\frac{9.6}{10.5} = 0.915$ barrel per knot.

The economy to be gained through the application of electrically driven auxiliary machinery, in fuel consumption alone, may readily be seen from the following estimates:

Electric Auxiliaries

Superheat, 75 Degrees F.

Heating Feed Water.—The proposed method would be to extract sufficient steam from the turbine for feed-water heater requirements.

Steam Consumption, per Hour:

	Pounds
Main turbine, 2,500 horsepower	30,600
Turbine generator	2,640
Air ejector	1,000
Total	34,240

Note—3,600 pounds per hour steam will be extracted from main turbine at about 10 pounds gage to heat feed water.

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Steam per Shaft Horsepower Hour, all Purposes:

$$\frac{34,240}{2,500} = 13.7 \text{ pounds}$$

Boiler Evaporation.—Estimated for comparative purposes at 13.5 pounds per pound of fuel. With the lesser quantity of steam to generate, however, the boiler efficiency would be improved in actual practice.

Fuel Consumption:

Fuel per hour, $\frac{34,240}{13.5} = 2,536$ pounds $= 7.9$ barrels.

Fuel per day, 60,864 pounds = 27 tons.
Fuel per day, in barrels = 189 barrels.

Fuel per Shaft Horsepower Hour:

$$\frac{2,536}{2,500} = 1.01 \text{ pounds.}$$

Fuel in Barrels per Knot:

Assuming a speed of 10.5 knots, $\frac{7.9}{10.5} = 0.75$ barrel per knot.

The application of high superheat, well within the limits of present-day design, and electric auxiliaries present a very interesting and high economic value in ship propulsion.

ELECTRICAL AUXILIARIES
Superheat, 200 Degrees F.

Steam Consumption, per Hour:

	Pounds
Main turbine, 2,500 horsepower	27,000
Turbine generator	2,400
Air ejector	1,000
	30,400

NOTE—3,000 pounds per hour steam will be extracted from main turbine at about 10 pounds gage to heat feed water.

Steam per Shaft Horsepower Hour, all Purposes:

$$\frac{30,400}{2,500} = 12.15 \text{ pounds.}$$

Boiler Evaporation:

Assumed at 13 pounds per pound of fuel.

Fuel Consumption:

Fuel per hour $= \frac{30,400}{13} = 2,340$ pounds $= 7.33$ barrels.

Fuel per day, 56,200 pounds = 25.1 tons.
Fuel in barrels per day = 176 barrels.

Fuel per Shaft Horsepower Hour:

$$\frac{2,340}{2,500} = 0.936 \text{ pound.}$$

Fuel in Barrels per Knot:

Assuming a speed of 10.5 knots, $\frac{7.33}{10.5} = 0.698$ barrel per knot.

These estimates show the saving in fuel consumption by the use of electric auxiliaries, as follows:

Saving in Fuel Consumption (at sea):

Steam auxiliaries, 230 barrels.
Electric auxiliaries, 189 barrels, 17.3 percent.
Electric auxiliaries, with 200 degrees F., 176 barrels, 23.5 percent.

Saving per Year:

208 days at sea, oil at $1.50 per barrel.
Electric auxiliaries, 8,320 barrels at $1.50 = $12,480.
Electric auxiliaries, with 200 degrees F. superheat, 11,250 barrels at $1.50 = $16,900.

In the estimate, an allowance was made of 40 barrels per day in port. With electric auxiliaries and economic engine-room machinery, it should be possible to reduce this by one-half.

157 days × 20 pounds × $1.50 = $4,710.

With a good system in the engine room, the lubricating oil required would be greatly reduced.

2. *Port Charges.*—In giving thoughtful consideration to improving the earning power of a ship, it will be recognized as essential to decrease its idle time, as certain charges are continuous, whereas the ship is actually earning money only when traveling between ports. When it is realized that the average cargo ship makes only about 36,000 miles per year and that at an average speed of 10 knots, which means that she is at sea only about 150 days out of a year, it is very evident that there is a big field for improvement.

Port charges estimated for the coastwise schedule mentioned above are as follows:

	New York	Colon	Los Angeles	San Francisco	Seattle	Total
(a) Wharfage	$7,800.00	...	$1,560	$3,120	$3,120	$15,600.00
(b) Lighterage	....	....	....	....	....	....
(c) Pilots' fees	202.56	....	200	250	....	652.56
(d) Stevedoring	7,800.00	....	1,560	3,120	3,120	15,600.00
(e) Tugboat charges	100.00	....	....	200	....	300.00
(f) Canal dues	.....	$4,150	....	....	....	4,150.00
Total per trip						$36,302.56
Total per year (four round trips)						290,420.48

It will be evident that any means which will reduce the time a ship has to lie at the wharf loading or unloading cargo should lessen the two items, wharfage and stevedoring. The writer has been informed of specific cases where ships have been delayed at docks due to freezing of steam-deck machinery. He has also been informed of a specific case where with two similar ships loading and unloading the same kind of cargo at the same dock and with the same stevedore foreman, the electrically equipped ship loaded in very much less time. Another specific case was where a number of ships fitted with steam-deck machinery had to await the derrick to assist in loading heavy cargo, while a ship fitted with electric machinery was able to handle its own cargo and saved a number of days' delay.

Delays have been experienced with steam machinery due to low steam pressure. This may not be due to drop in boiler pressure but to loss in piping. With electric equipment there is always ample power available for the winches.

By the use of the most suitable electric machinery, it should be possible to reduce the item of port charges 10 percent. In the estimate given above this would mean approximately $30,000 per year saving.

3. *Salaries.*—In all probability the salaries would not be directly affected. In the larger ships and in those where there is a very large amount of auxiliary power it might be found desirable to increase the salary slightly for one of the positions, in order to secure a man with electrical experience.

4 and 5. *Upkeep and Repairs.*—Both of these items should be reduced. With properly designed electric machinery, the charges for repairs and maintenance would be less than with steam machinery. If compared with many existing ships, a 20 percent reduction would in all probability be a conservative estimate. If we only allow 10 percent, however, this would mean a saving of approximately $3,000 per year on the above estimate.

6. *Supplies.*—This item would not be appreciably affected in the deck department, but for the engine department there should be a material reduction. A saving of 10 percent might be expected, which would amount to $2,000 per year.

7. *Insurance.*—The assured reliability of proper electrical machinery in the engine room, along with the elimination of a large amount of piping carrying high pressure steam, should have a direct bearing on the insurance rate. Indirectly, by reducing the loss of steam it should be possible to maintain the water in the boilers in almost perfect condition. This should still further add to the safety of a ship. It would seem to be justifiable to expect that the insurance premiums can be decreased about 5 percent; this would mean a saving of approximately $3,000 per year.

8. *Loss and Damage.*—This item in all probability would not be affected.

The sum of the different gains mentioned above totals $55,190 per year. The amount of saving that can be shown by other estimates will naturally vary with conditions. In any estimates the possibility of making a substantial gain in the earning capacity in a ship is a real one. Having in mind certain ships, there is every reason to believe that the figures mentioned above might be increased.

One of the latest British combined cargo and passenger ships is equipped electrically and is fitted with over 100 motors driving auxiliary apparatus. Needless to say, the owners of new foreign ships are fitting them with electrically driven machinery only because they have satisfied themselves that it is profitable to do so. We engineers in this country should combine our efforts and avail ourselves of every opportunity to improve the efficiency of our merchant ships.

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The Influence of Shape of Transverse Sections Upon the Resistance of Vessels of Moderate Speed*

By Professor Herbert C. Sadler† and Professor E. M. Bragg††

FROM time to time results of experiments on the influence of shape of bow and stern sections upon the resistance of ships' forms have been recorded, but usually these have referred to special cases, sometimes accompanied by other changes of form and generally for vessels of somewhat high speed.

Froude's original dictum of U-shaped sections forward and V-shaped aft still lingers in the minds of most designers as applicable to all forms at all speeds. Some years ago some experiments on models of full form were conducted in the experimental tank at the University of Michigan (see Vol. 17, Society of Naval Architects and Marine Engineers), in which it appeared that the V-shaped sections, both forward and aft, gave the better results.

The following investigation was therefore undertaken with the object of covering the field more fully, especially for the slower and moderate speed types.

The parent body plans and curve of sectional areas are shown in Fig. 1, and indicate the changes in type of sections used. They are based upon a vessel 425 feet between perpendiculars by 56 feet, with a normal load draft of 24 feet 9 inches, and a deep load of 27 feet 9 inches. The vessel has a cruiser stern and a length on the deep load line of 435 feet, this length forming the basis that was used for the spacing of sections.

The shape of the cruiser stern had to be modified slightly with different lengths of run for fairing purposes, but at the 24-foot 9-inch draft the change in length was negligible.

The various percentages of ends and middle bodies are given in terms of the length between perpendiculars. All the results have been reduced to a temperature of 65 degrees F.

In general, two parent forms were taken as follows:

1. A model with a fixed length of run and with "medium" type of stern sections.
2. A model with a fixed length of entrance and "medium" type of bow sections.

Each model was further modified in the following manner:

Fixed run 40.5 per cent L. B. P.	Five lengths of entrance from 23.7 percent to 48.5 percent L. B. P.	Each type with U, Medium, and V-shaped sections forward.
Fixed entrance 27 percent L. B. P.	Four lengths of run from 24.3 percent to 48.6 percent L. B. P.	Each type with U, Medium, and V-shaped sections aft.

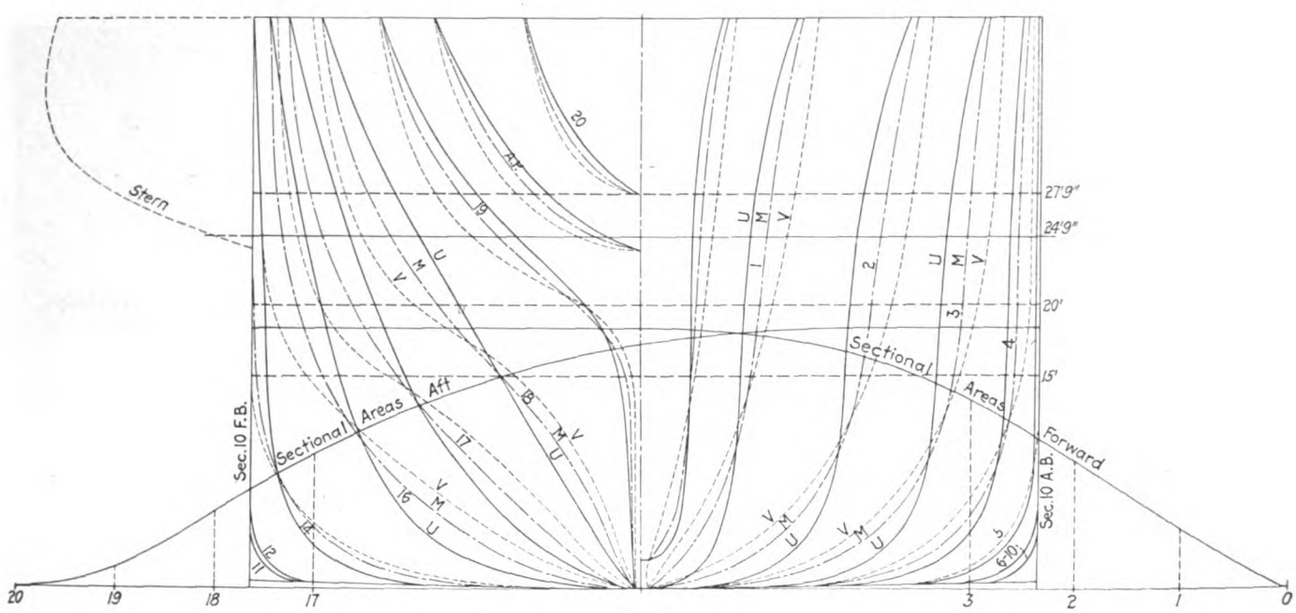

Fig. 1

The parent forms, with the above lengths of entrance and run, were selected from a former series of experiments covering some hundred types and appeared to be those that gave the best results from a resistance standpoint, for the range of speeds suitable for the present series of models. Each model was tested at four different drafts and consequently represents four types of vessels with varying ratios of beam to draft, and varying prismatic coefficients.

The particulars of the parent form are given in the following table, the prismatic coefficients being for the whole vessel, and a parallel middle body of 32.5 percent.

	Bow sections varying	*Stern sections varying*	*B/d*
15-foot draft	U, .734	.737	3.73
	M, .730	.728	
	V, .727	.721	
20-foot draft	U, .756	.757	2.8
	M, .754	.753	
	V, .753	.750	
24-foot 9-inch draft.....	U, .772	.772	2.26
	M, .772	.772	
	V, .772	.772	
27-foot 9-inch draft.....	U, .785	.783	2.02
	M, .786	.784	
	V, .787	.785	

*Paper read before the Society of Naval Architects and Marine Engineers, November, 1921.

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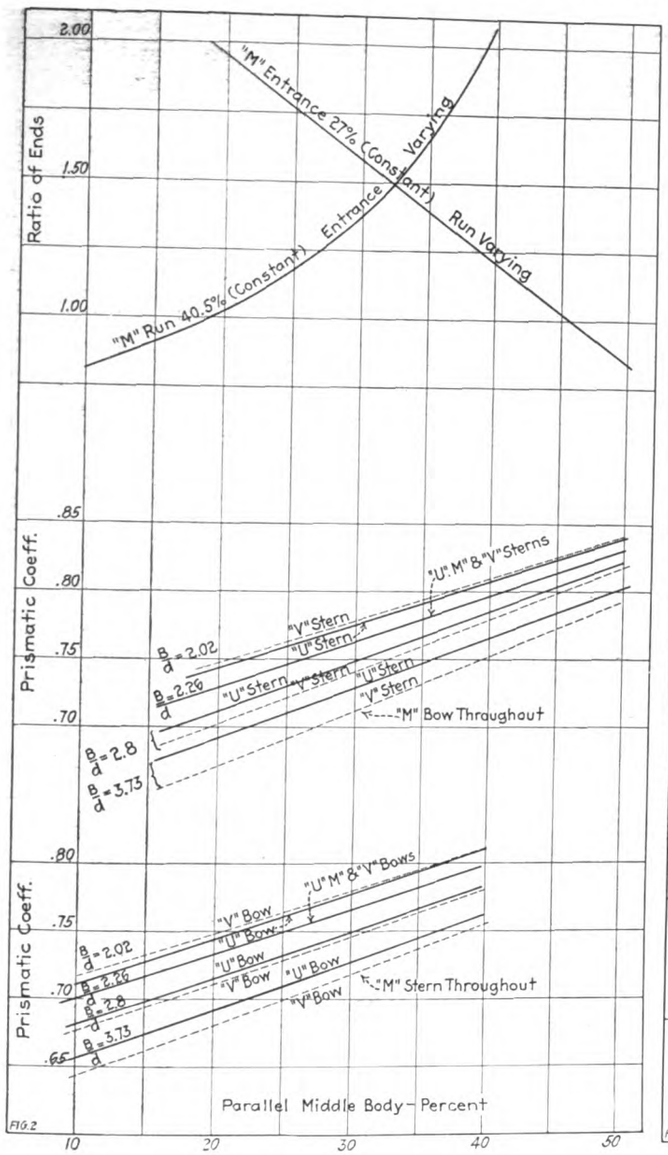

Fig. 2

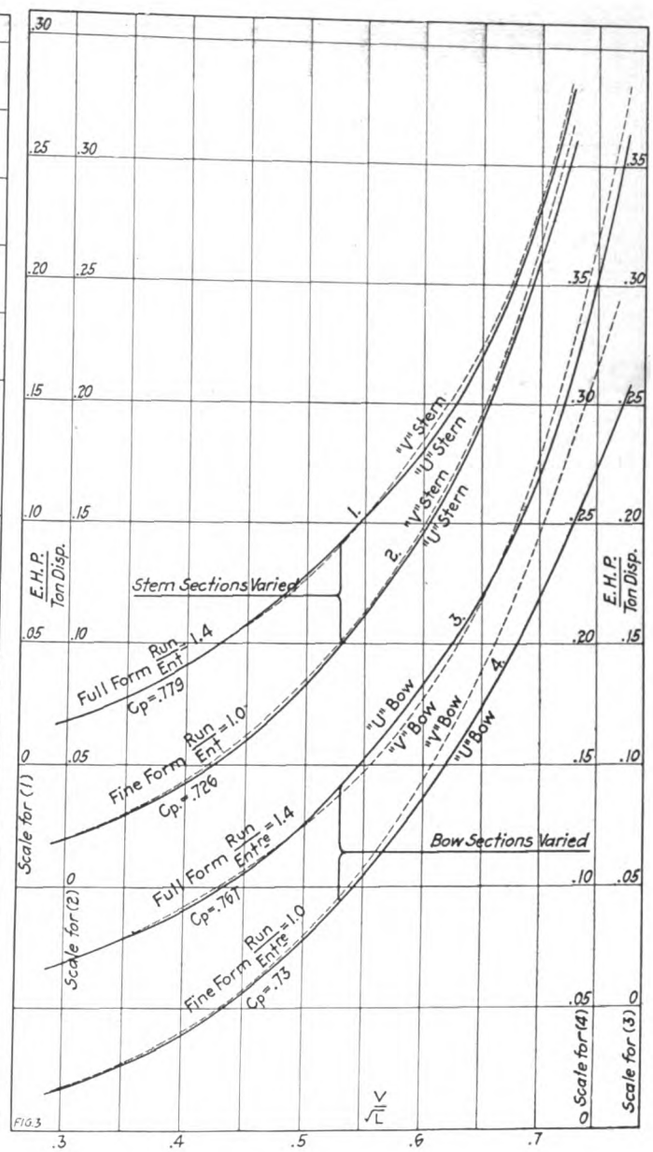
E.H.P. / Ton Disp.
Stem Sections Varied
Full Form Run / Ent = 1.4 Cp = .779
Fine Form Run / Ent = 1.0 Cp = .726
Full Form Run / Ent = 1.4 Cp = .767
Fine Form Run / Ent = 1.0 Cp = .73
"V" Stern
"U" Stern
"U" Bow
"V" Bow
Bow Sections Varied
Scale for (1)
Scale for (2)
Scale for (3)
Scale for (4)
V / √L
FIG.3

Fig. 3

For other variations of percentage of middle body and ends the change in prismatic coefficient is shown in Fig. 2.

METHODS OF PLOTTING RESULTS

There has been some discussion in this and other countries as to the various methods used for recording the results of tank experiments. Here it has been customary to give the residuary resistance in pounds per ton of displacement on a speed-length ratio base. Abroad, the Froude constant system or **C** values, or a modification by Baker, or **P** values have been used. Arguments pro and con for each system can be made, but the deciding factor rests in the use to which the results are to be put. If for general comparative purposes in tank work, then the **C** values on a speed-length ratio base, or even **P** values, possess certain advantages. In other words, the "ideally best" vessel may be readily determined. If, however, the results are to be used by the practicing naval architects, it would seem that a somewhat more simple form would be preferable, especially as limiting conditions of design, and the necessity of arriving at the results of minor modifications quickly are the governing factors.

The following results have therefore been plotted in the form of effective horsepower per ton of displacement or $\frac{\text{EHP}}{\text{Tons}}$ upon a speed-length ratio or $\frac{V}{\sqrt{L}}$ base, and apply directly to a 425-foot ship.

They can be readily modified for any other length by multiplying by the square root of the length ratio up to a difference of 10 percent either way, and within the limits of, say, 2 or 3 percent either way may be taken as practically constant for a given speed-length ratio.

Another reason why there appears to be no particular necessity for having a system which will apply to all lengths of ships from the model up is that in practice the ratio of length to beam, and beam to draft will vary considerably in passing from a small to a large vessel, and therefore the results of any set of experiments must necessarily have a somewhat limited application, depending upon the relative sizes and types of vessels.

The ratio of horsepower to displacement is also one of the factors entering into the economy of vessels and hence in preliminary design work may have to be taken into account.

A discussion of the proposed method is given in the appendix.

In order to exaggerate certain features in the present paper so that the diagrams will show more clearly the effect of the

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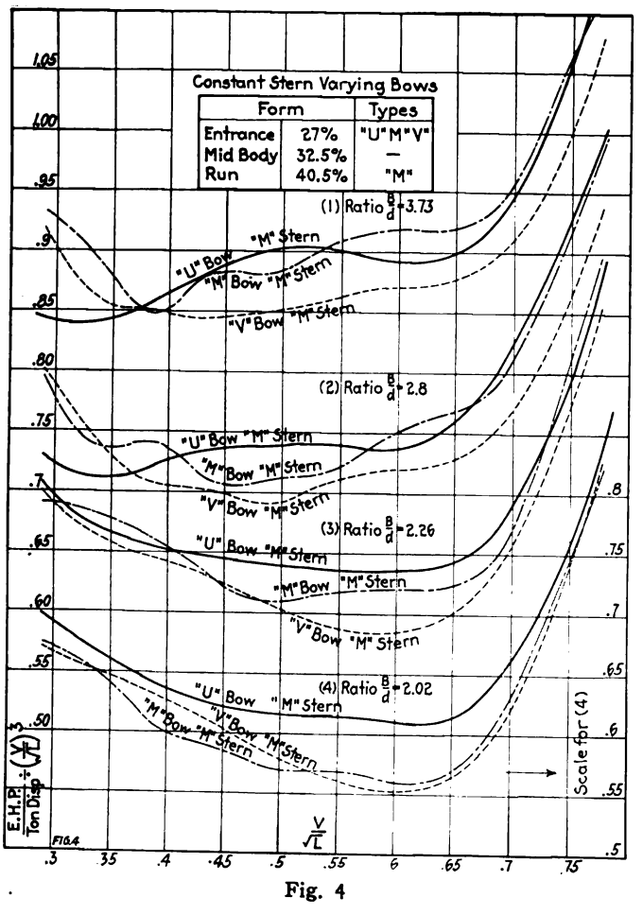

Fig. 4

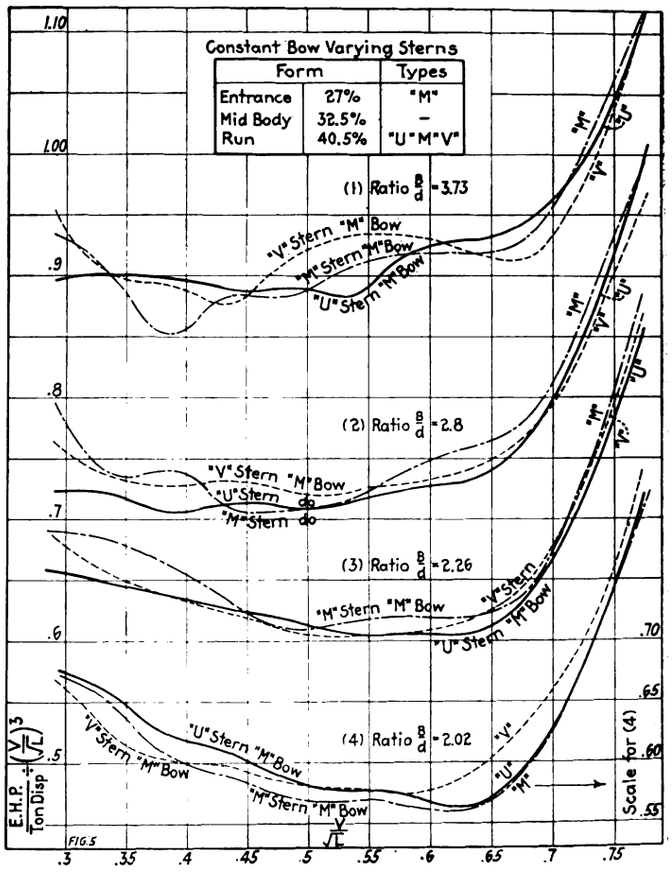

Fig. 5

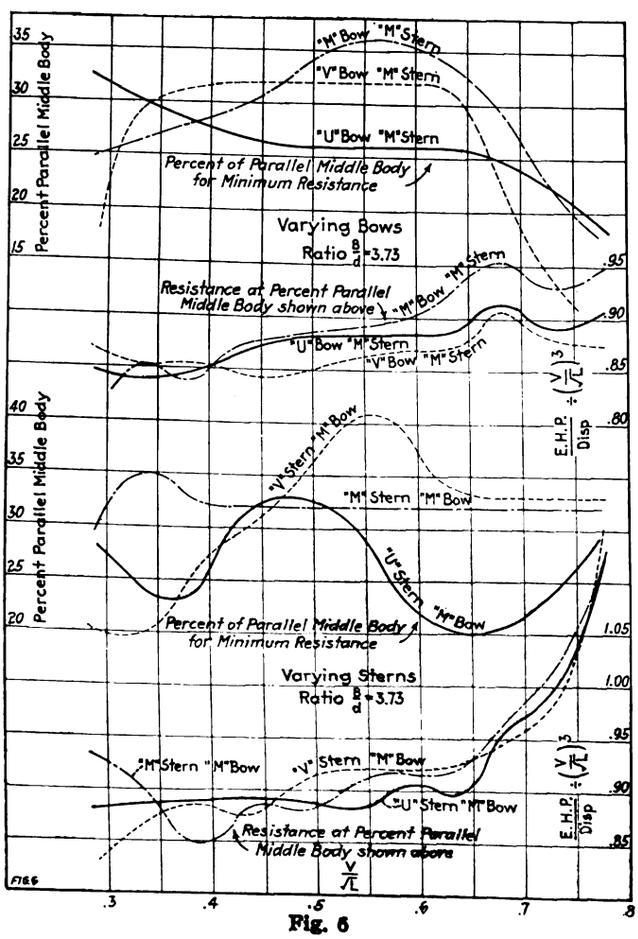
"M" Bow "M" Stern
"V" Bow "M" Stern
"U" Bow "M" Stern
Percent of Parallel Middle Body for Minimum Resistance
Varying Bows
Ratio B/d = 3.73
Resistance at Percent Parallel Middle Body shown above
"M" Bow "M" Stern
"U" Bow "M" Stern
"V" Bow "M" Stern
Percent Parallel Middle Body
E.H.P. / Disp ÷ (V/√L)³
"V" Stern "M" Bow
"M" Stern "M" Bow
"U" Stern "M" Bow
Percent of Parallel Middle Body for Minimum Resistance
Varying Sterns
Ratio B/d = 3.73
"M" Stern "M" Bow
"V" Stern "M" Bow
"U" Stern "M" Bow
Resistance at Percent Parallel Middle Body shown above
V/√L
FIG.6

Fig. 6

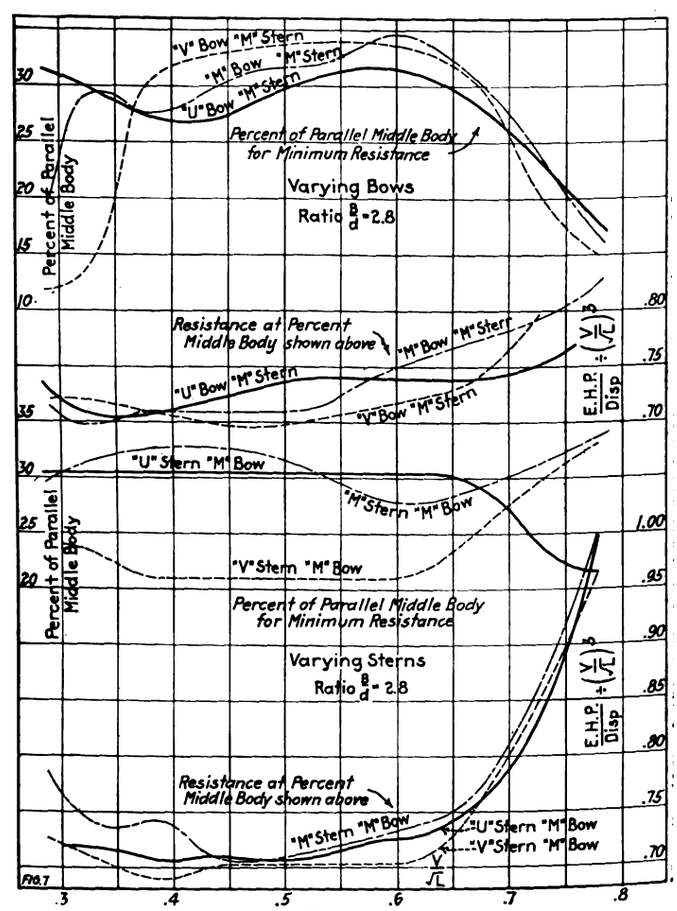
"V" Bow "M" Stern
"M" Bow "M" Stern
"U" Bow "M" Stern
Percent of Parallel Middle Body for Minimum Resistance
Varying Bows
Ratio B/d = 2.8
Percent of Parallel Middle Body
Resistance at Percent Middle Body shown above
"M" Bow "M" Stern
"U" Bow "M" Stern
"V" Bow "M" Stern
E.H.P. / Disp ÷ (V/√L)³
"U" Stern "M" Bow
"M" Stern "M" Bow
"V" Stern "M" Bow
Percent of Parallel Middle Body for Minimum Resistance
Varying Sterns
Ratio B/d = 2.8
Resistance at Percent Middle Body shown above
"M" Stern "M" Bow
"U" Stern "M" Bow
"V" Stern "M" Bow
V/√L
FIG.7

Fig. 7

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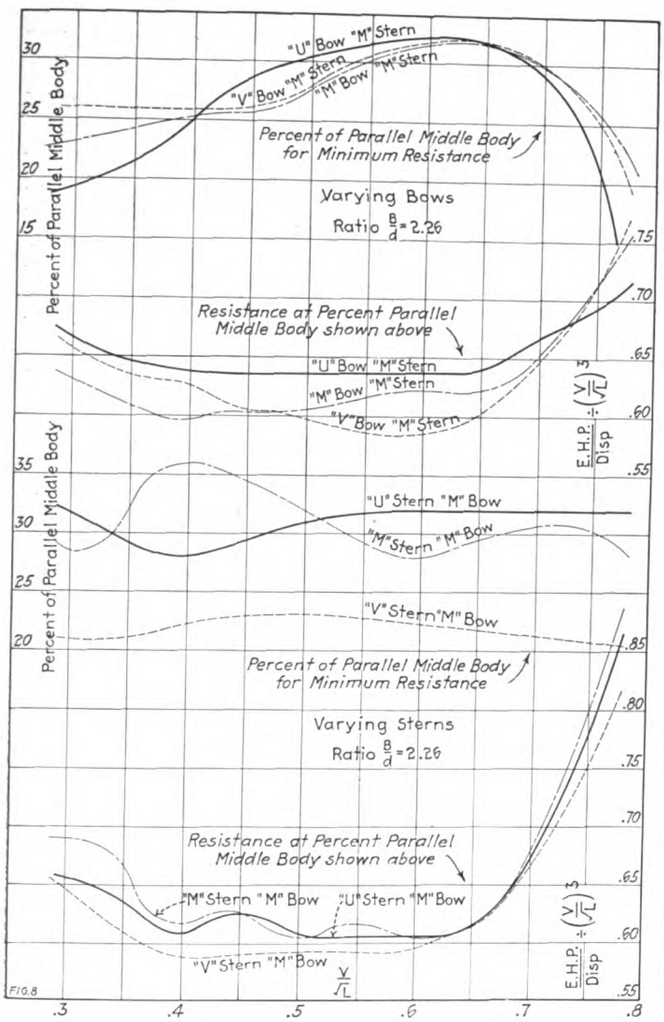
"U" Bow "M" Stern
"V" Bow "M" Stern
"M" Bow "M" Stern
Percent of Parallel Middle Body for Minimum Resistance
Varying Bows
Ratio B/d = 2.26
Resistance at Percent Parallel Middle Body shown above
"U" Bow "M" Stern
"M" Bow "M" Stern
"V" Bow "M" Stern
"U" Stern "M" Bow
"M" Stern "M" Bow
"V" Stern "M" Bow
Percent of Parallel Middle Body for Minimum Resistance
Varying Sterns
Ratio B/d = 2.26
Resistance at Percent Parallel Middle Body shown above
"M" Stern "M" Bow
"U" Stern "M" Bow
"V" Stern "M" Bow
Percent of Parallel Middle Body
E.H.P. / Disp (V/√L)³
V/√L
FIG.8

Fig. 8

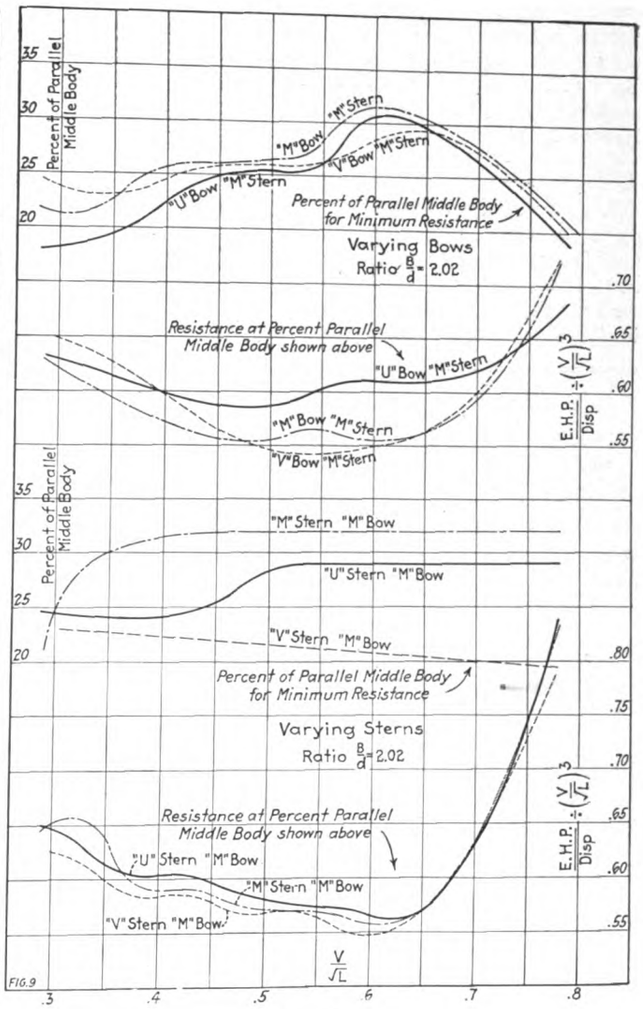
"M" Stern
"M" Bow
"V" Bow "M" Stern
"U" Bow "M" Stern
Percent of Parallel Middle Body for Minimum Resistance
Varying Bows
Ratio B/d = 2.02
Resistance at Percent Parallel Middle Body shown above
"U" Bow "M" Stern
"M" Bow "M" Stern
"V" Bow "M" Stern
"M" Stern "M" Bow
"U" Stern "M" Bow
"V" Stern "M" Bow
Percent of Parallel Middle Body for Minimum Resistance
Varying Sterns
Ratio B/d = 2.02
Resistance at Percent Parallel Middle Body shown above
"U" Stern "M" Bow
"M" Stern "M" Bow
"V" Stern "M" Bow
Percent of Parallel Middle Body
E.H.P. / Disp (V/√L)³
V/√L
FIG.9

Fig. 9

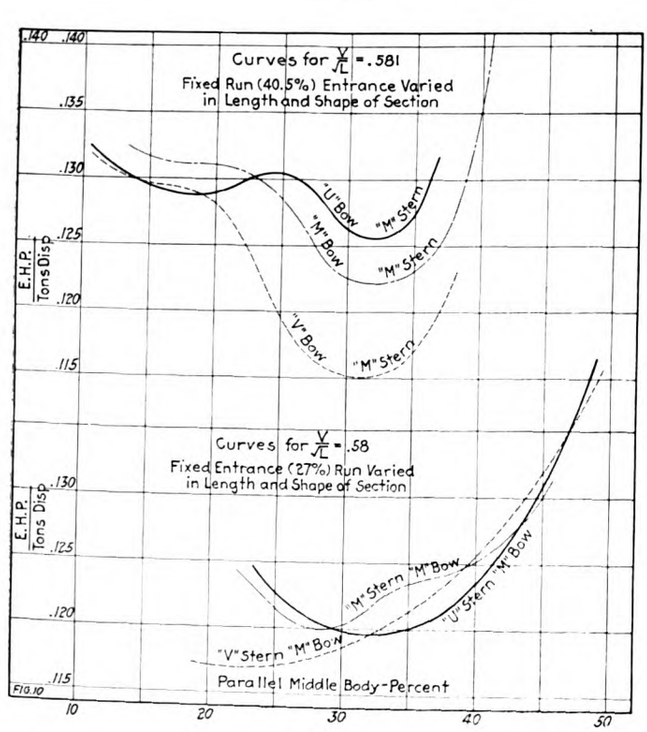
Curves for V/√L = .581
Fixed Run (40.5%) Entrance Varied in Length and Shape of Section
"U" Bow "M" Stern
"M" Bow "M" Stern
"V" Bow "M" Stern
Curves for V/√L = .58
Fixed Entrance (27%) Run Varied in Length and Shape of Section
"M" Stern "M" Bow
"U" Stern "M" Bow
"V" Stern "M" Bow
E.H.P. / Tons Disp
Parallel Middle Body-Percent
FIG.10

Fig. 10

varying of the shape of section of the vessel and to bring them into the limited dimensions of the volumes of our transactions, some of the figures have been modified by a factor representing the cube of the speed-length ratio.

Results of Experiments

As a general comparison of U- and V-shaped sections Fig. 3 shows the effect upon the resistance for a full and a fine vessel with (*a*) stern sections and (*b*) with bow sections varied. With regard to the influence of bow sections it is apparent that, within the range of speed suitable for the vessel concerned, the V-shaped sections are best for the full form and the U-shaped sections for the fine form.

When the stern sections only are varied, the influence upon resistance is not so marked, but in general the U-shape appears to give the better results. It should be remarked, however, that the so-called U-sections aft are of the moderate type and not so pronounced as the corresponding bow sections.

The diagrams shown in Fig. 4 and Fig. 5 illustrate, for a selected model, the variation of resistance in terms of speed due to modification of bow sections with a constant medium type of stern, and modification of stern sections with constant medium type of bow; and also the influence of change of draft from the light to the deep load.

Figs. 5, 6, 7, 8 and 9 show the percentage of parallel middle body at which the resistance is minimum for any given speed, and the value of the effective horsepower per ton at that speed. They have been obtained from curves sim-

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ilar to that shown in Fig. 10, which illustrates the effect of the various changes for a selected speed-length ratio of .581. Each of the above figures refers to a given draft or, for the models concerned, a variation of breadth to draft of from 3.73 to 2.02.

CONCLUSIONS

A study of the diagrams will reveal certain facts which are of interest. In the first place, it is evident that no hard and fast rule can be laid down as to the best type of bow and stern sections for all ships at all speeds; and, in the second, that the best type of section for a given ship at the load draft is not necessarily the best for the same ship at lighter drafts. The selection of the best type of section will depend upon:

1. The speed-length ratio.
2. The fullness of the vessel.
3. The distribution of displacement longitudinally.
4. The ratio of breadth to draft.

Certain rather broad conclusions may, however, be drawn In the finer types of vessels of the merchant ship type and at speed-length ratios over .75 and not exceeding, say, 1.0, the U-shaped bow sections accompanied with moderately V-shaped sections aft, *i. e.*, sections not too full on the waterline, will in general give good results.

In the fuller types and at speed-length ratios in the neighborhood of about .6 or under, the V-shaped bow sections, accompanied with moderate stern sections as above, will, in the majority of cases, give a satisfactory form.

If it is anticipated that the vessel is to run at reduced draft for any appreciable percentage of her time, then the U-shaped bow sections lose their advantage, and a compromise section will prove more satisfactory. Oil-carrying vessels and lake ore carriers are an illustration of the case where the vessel runs for 50 percent of its time at a considerably reduced draft.

The underlying cause of the variation of resistance due to shape of section is probably to be found in the general conditions of stream-line flow at the ends, so that the prismatic coefficient of the ends, combined with the speed-length ratio of ends and also what might be called "diagonal fineness," will influence the results. Admiral Taylor's experiments on stream-line flow around vessels show conclusively that a good deal of the general flow is in a downward direction and, consequently, anything that can be done to make the path as easy as possible; *i. e.*, by paying some attention to the lower parts of the sections, particularly where these fair into the midship part, will probably reduce resistance.

Appendix

The effective horsepower of any ship taken as a model will be

$$\text{E.H.P.}_1 = (f_1 S_1 V_1^{2.83} + R_w V_1) \times .00307$$

f_1 = Coefficient of friction for model ship.
S_1 = Wetted surface of model ship.
V_1 = Speed of model ship in knots.
R_w = Wave resistance of model ship in pounds.

At the same speed-length ratio the effective horsepower of a similar ship whose dimensions have the linear ratio λ to the model will be

$$\text{E.H.P.}_2 = (f_2 S_1 \lambda^2 (V_1 \lambda^{.5})^{2.83} + R_w \lambda^3 V_1 \lambda^{.5}) \times .00307$$
$$= (f_2 S_1 \lambda^{3.415} V_1^{2.83} + R_w V_1 \lambda^{3.5}) \times .00307$$
$$\therefore \text{E.H.P.}_2 = (\text{E.H.P.}_1 \lambda^{3.5} - (f_1 \lambda^{3.5} - f_2 \lambda^{3.415}) S_1 V_1^{2.83} \times .00307$$

In terms of effective horsepower per ton of displacement, since displacement varies as λ^3:

$$\frac{\text{E.H.P.}_2}{\text{Dispt.}_2} = \frac{\text{E.H.P.}_1}{\text{Dispt.}_1} \lambda^{.5} - (f_1 \lambda^{.5} - f_2 \lambda^{.415}) \frac{S_1}{\text{Dispt.}_1} V_1^{2.83} \times .00307$$

Where the similar ship is only 10 to 12 percent longer or shorter than the model ship, the second term can be neglected without introducing any serious error, and the effective horsepower per ton obtained by multiplying the similar quantity for the model ship by $\lambda^{.5}$. The power so obtained is for the same speed-length ratio as in the model ship.

As an illustration, the following table has been prepared for a model ship of 425 feet:

Similar ship	λ	Beam	Beam = $\frac{L}{10}$ +	$\lambda^{.5}$	f_1	$f_1 \lambda^{.5}$	f_2	$\lambda^{.415}$	$f_2 \lambda^{.415}$	$f_1 \lambda^{.5} - f_2 \lambda^{.415}$
375	.882	49.5	12.0	.94	.....	.00853	.00913	.949	.00867	— .00014
425	1.00	56.0	13.5	1.00	.00908	.....	.....	.....	.....	.....
475	1.118	62.5	15.0	1.057	.....	.00960	.00905	1.047	.00947	+ .00013

At the deepest draft the ratio of wetted surface in square feet to displacement in tons does not exceed 2.9 for the model ship, and for the lightest draft rarely exceeds 4.0.

At the high speed-length ratio for this type of .68, the value of $V^{2.83}$ is about 2,000. Using these values for a similar ship where $\lambda = .882$ the value of the corrections becomes:

$$+ .00014 \times (4 \times 2{,}000 \times .00307) = .0034$$

At the lowest draft the effective horsepower per ton of displacement of the model ship is about .30. If the simplified expression is used, the effective horsepower per ton for a similar ship will be $.3 \times .94 = .282$; and if the complete expression be used it will be $.3 \times .94 + .0034 = .2854$ at the same speed-length ratio.

In this extreme case the correction amounts to a trifle more than one percent.

Naval Architects to Hold Spring Meeting

THE Society of Naval Architects and Marine Engineers will hold a spring meeting at the Automobile Club of America, 247 West 54th street, New York, on Friday, May 19, 1922, at 8 P. M.

The meeting this spring will be of special interest to shipowners and operators. This is particularly appropriate at this time because Congress is about to decide whether or not America shall adopt constructive legislation that will insure the successful operation of an American merchant marine. It is of course evident that the future of all members of the society interested in the building of ships, propelling machinery, auxiliaries and of the material and equipment that enter into ship construction depends upon successful ship operation.

Capt. Eugene E. O'Donnell, manager, marine department of C. H. Sprague & Son, will deliver a paper entitled "Operating Problems of the American Shipowner."

Through the courtesy of the International Mercantile Marine Company it has been arranged for the members of the society to visit and inspect the *Majestic* from 2 to 5 in the afternoon. This ship is the largest vessel afloat, having a gross tonnage of 56,000 tons, which is nearly 10,000 tons larger than the *Olympic*. It presents many elements of design and construction of interest to members of the society, so than an inspection of the ship should prove of great interest and value to them.

An informal dinner will be served at the Automobile Club of America at 6:30 P. M. At this dinner there will be no formal speeches, but there will be an address by a distinguished authority on shipping matters.

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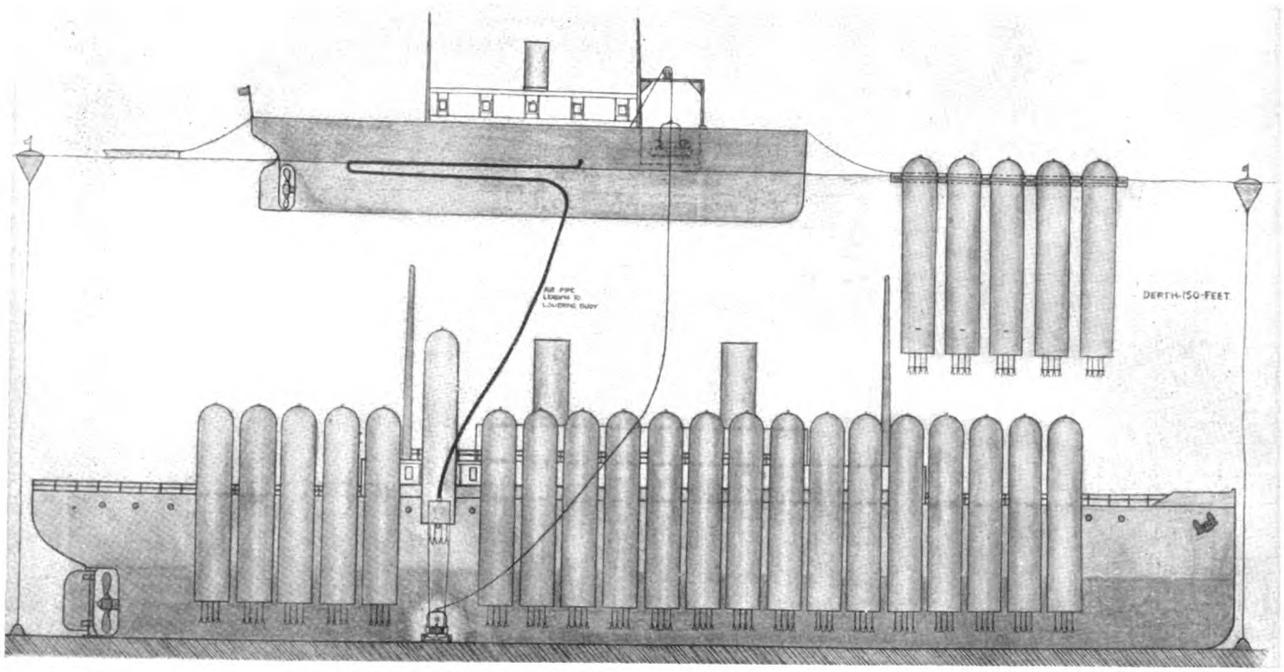

Fig. 1.—Sketch Showing Arrangement of Mother Ship, Submarine Tractor and Vertical Submerged Pontoons for Raising a Sunken Vessel

Vertical Submerged Pontoon System to Salvage Ships

Details of Proposed Method for Restoring Buoyancy to Sunken Vessels at Depths Up to 500 Feet

SYSTEMS of ship salvage employing surface pontoons have been used with success in raising vessels sunk in comparatively shallow waters, but although methods have been devised attempting to utilize similar principles in deeper water none has so far been particularly successful. A method recently developed, however, by Mr. Jesse W. Reno of New York, known as the Reno marine salvage system, offers possibilities for accomplishing the raising of vessels sunk at depths up to 500 feet by attaching a number of vertical submerged pontoons to the sides of the vessel and thus supplying the necessary buoyancy to bring it to the surface.

The location of the ship to be raised is first marked by two buoys at the bow and stern and a mother ship having control of the salvage operations is moored by cross anchors in a convenient position. In order to prepare the vessel for raising, a mobile working chamber, or submarine tractor, having two operators within it is lowered from the mother ship to the sea bottom. This submarine chamber is fitted for propulsion on the sea bottom with caterpillar tractor belts driven by an electric motor within the chamber. This motor also serves to drive twin boring drills and a windlass mounted on the platform of the machine. Current for the motor and for searchlights within the chamber is supplied from the mother ship as is also compressed air for filling the pontoons. Telephonic communication is provided through the lowering cable. Work is carried on in the submarine chamber under atmospheric pressure. The oxygen supply and the method of removing impurities from the air are similar to those employed in submarine boats.

With the working chamber on the sea bottom, the searchlights being turned on, the tractor belts are set in motion and the chamber brought alongside the ship where sets of 5-inch holes are bored through the ship's plates. These holes are located adjacent to the frames of the vessel so that subsequent strains in lifting are transmitted to the entire structure of the ship. The drills work simultaneously and tests have shown that a pair of holes can be completed in 4½ minutes. In the case of small vessels, holes are drilled in sets of four while in larger ships eight holes are necessary to accommodate the large size pontoons.

Arrangement of Lifting Pontoons

The second operation is the attaching of the pontoons which are cylindrical steel tanks closed at the top and open at the bottom. For general service it has been decided that pontoons 12 feet in diameter and 60 feet long are suitable, the number required being determined by the size of the ship to be raised. A vessel with pontoons attached is shown in Fig. 1. Fig. 2 indicates the method employed in attaching the lifting cables. These cables hang down from transverse girders within the pontoons and equalizing levers are arranged to insure equal loading of the cables. At the lower end of the cables are standard crane hooks which are inserted in the holes drilled in the ship's sides.

When preparing to sink the pontoons for attachment to a vessel they are partially filled with air, but only enough to keep them upright. This point is determined by an air valve in the head of each pontoon located so that surplus air escapes until the pontoon sinks in the water leaving its top awash.

The winding drum mounted on the submarine tractor is next brought into action. Two lengths of wire cable spaced about 8 feet apart and long enough to reach the surface are

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unwound and a hollow steel float attached to them raises them to the surface. This float is fitted at the top with a hook made to fit into a staple near the bottom of each pontoon; the float being at the surface, a diver places his feet in suitable recesses in its side and signals the working chamber at the sea bottom to pull him and the float down. When he reaches the bottom of the pontoon he inserts the hook of the float in the staple of the pontoon and his work being complete, rises to the surface, after which the pontoon is drawn

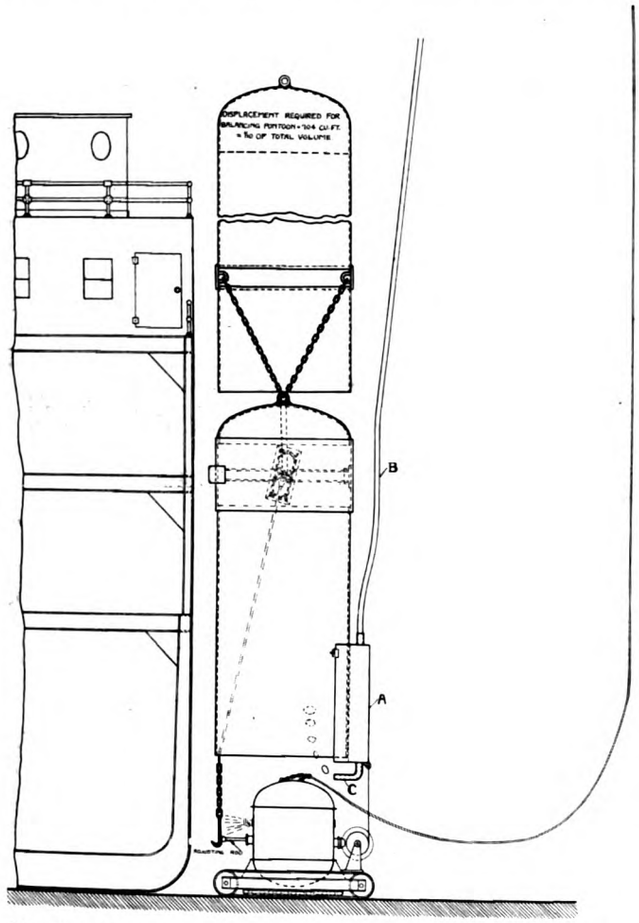

Fig. 2.—Method of Attaching Pontoon to Sunken Vessel by Submarine Tractor

to the bottom. The two cables insure the pontoon going down in proper position and a specially designed adjusting bar operated within the working chamber inserts the pontoon hooks in the holes drilled in the ship's side, Fig. 2.

Raising the Ship

With the pontoons in place it only remains to fill them with compressed air to raise the ship to the surface. A sea bottom syphon delivers the compressed air from the mother ship into each pontoon in turn. The end pontoons are first filled, those on the two sides alternately, to insure the proper balance, when the ship rises until it floats with its decks awash. From this point on the methods followed depend on the tides. If the rise of tide is sufficient, the ship is towed into shallow water, grounded at high tide and the pontoons removed. As the tide falls the water within the ship runs out through the numerous holes which at low tide are plugged by divers. The damage which caused the vessel to sink is patched and as the tide rises again the ship floats with her deck well above the surface of the water ready to be pumped out and towed into dock.

In locations where there is little or no tide a series of partially inflated box shaped pontoons may be placed under the vessel. The side pontoons are then partly deflated and drawn down one at a time by the cable drum on the working chamber and hooked along the lower edge of the box pontoons. The holes in the ship are then plugged, the box and side pontoons fully inflated and the added buoyancy raises the ship with its deck well above the surface ready to be pumped out.

Annual Meeting of the Institution of Naval Architects

THE Institution of Naval Architects held its annual meeting in the lecture hall of the Royal United Service Institution, Whitehall, W. C. 2, London, England, on April 5, 6 and 7, at which the following papers were presented:

"Merchant Shipping and World Commerce in Relation to Sea Power." By Sir Westcott Abell, K. B. E., M. Eng.

"Three Steps in Naval Construction—*King Edward VII—Lord Nelson—Dreadnought.*" By J. H. Narbeth, C. B. E., M. V. O.

"Resistance of Ships Among Waves." By J. L. Kent.

"Nodal Arrangements of Geared Drives." By Dr. J. H. Smith.

"Double Reduction Gears in the S. S. *Melmore Head.*" By J. W. Wilkie.

"A Method of Determining the Natural Periods of Vibration of Ships." By T. C. Tobin, M. A.

"Possibilities of Fuel Economy in Marine Boilers." By John Reid.

"The Metering of Steam." By J. L. Hodgson.

"Diesel Machinery for Single Screw Motorships." By James Richardson.

"Longitudinal Strength of Cargo Vessels and Its Variation with Fullness of Form." By E. L. Champness, M. B. E., M. Sc.

"Some Special Cases of Two-Dimensional Stress or Strain." By Prof. C. E. Inglis, M. A.

"The Economic Efficiency of Merchant Ships." By John Tutin.

"Recent Developments in Motor Lifeboats." By J. Rennie Barnett, O. B. E.

An evening reception at which the president, His Grace the Duke of Northumberland, received the guests, was held on April 4 and the annual dinner of the Institution was held on Wednesday, April 5.

The Council is arranging to hold a Summer Meeting of the Institution in Paris on July 4, 5 and 6, particulars of which will be issued in May.

New Type Expansion Joint

THE Ray Expansion Joint Company, Inc., of 95 Liberty Street, New York City, has recently introduced in the marine field a new type expansion joint consisting primarily of two flanges connected together by means of a flexible element, the flanges being guided relatively to each

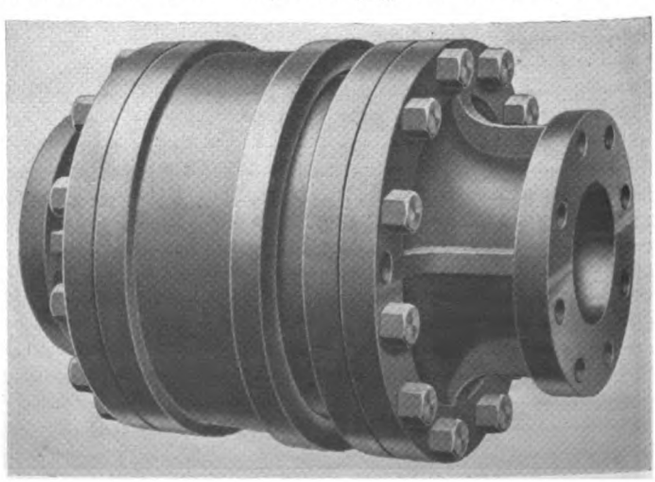

Fig. 1.—Ray Expansion Joint—Exterior View

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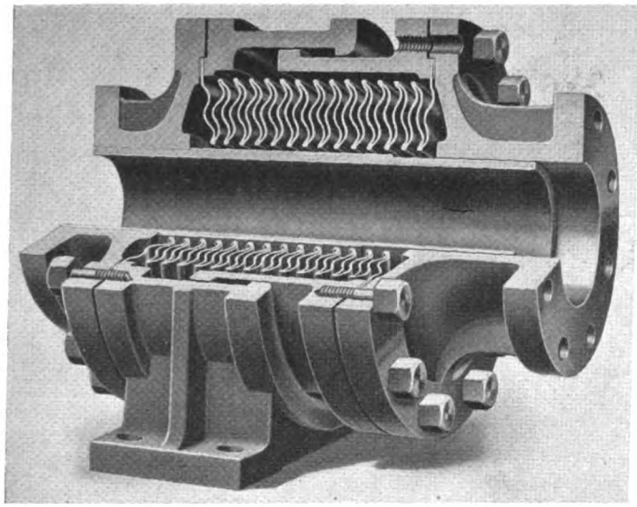


Fig. 2.—Ray Expansion Joint—Section Showing Details of Construction

other in such a manner as to permit longitudinal movement and at the same time prevent lateral movement.

The elastic element consists of a number of corrugated steel discs, alternately welded together at their inner and outer circumferences, the end discs being provided with enlarged flanges for attaching to the flanged end pieces. The discs are pressed from plates of special crucible nickel steel which, when subjected to the particular heat treatment given the completed element, has an elastic limit of approximately 170,000 pounds per square inch and an ultimate strength of about 220,000 pounds combined with great toughness or resiliency. Due to their construction and the special metal of which they are composed, these discs will function for long periods of time without giving way to fatigue caused by the alternating stresses to which they are subjected by the expansion and contraction of the pipe line.

A tube in the bore of the joint acts as a guide for the movable head and in addition to protecting the elastic element from the entrance of foreign bodies between the discs, prevents the escape of any appreciable amount of steam or liquid in case of a breakage in the elastic element. The construction is such that a slight leakage past this tube is kept within the elastic element because the end flanges are made absolutely tight with suitable gaskets.

One of the particular advantages claimed for this joint is the fact that it may be installed in inaccessible places such as the main suction lines aboard tankers and several large oil companies are considering the installation of these joints for this service.

While this new type of joint has not been in service long enough to determine the life of the flexible element under actual working conditions, the manufacturers estimate the life to be from ten to fifteen years. Even should the life, however, be limited to four or five years, the ease with which a new flexible element could be installed and the absence, during that time, of packing troubles would justify its use.

Ray expansion joints are made in standard sizes to resist oil or steam pressures up to 250 pounds and expansions up to three inches. Special designs, however, are available for joints with a total movement up to 16 inches.

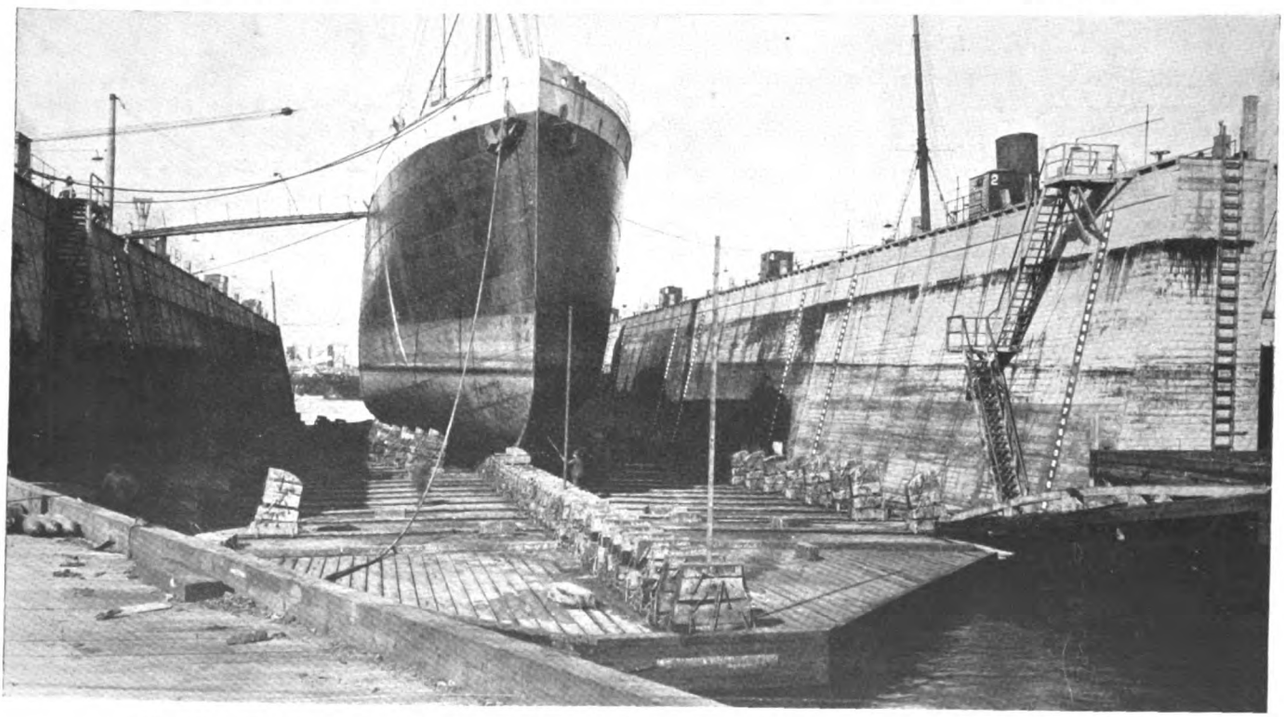
Controlling a Floating Dry Dock With Push Buttons

By James Goldsborough*

ONE of the latest developments in the control of dry docks is illustrated by the 14,000-ton, four-section, floating dock recently erected in the yards of Theodore A. Crane's Sons Company, Erie Basin, Brooklyn, N. Y.

All of the pumps are controlled directly by the dock master himself. He stands in a little house, directly facing the dock, where he has a clear view of all proceedings. Within this house is a waterproof cabinet which contains eight sets of push buttons, each set consisting of two buttons marked "start" and "stop," respectively. The sets are numbered

* Westinghouse Electric & Manufacturing Company.



New Crane Dry Dock in Which the Pumps Are Controlled by Automatic Push Button Controllers

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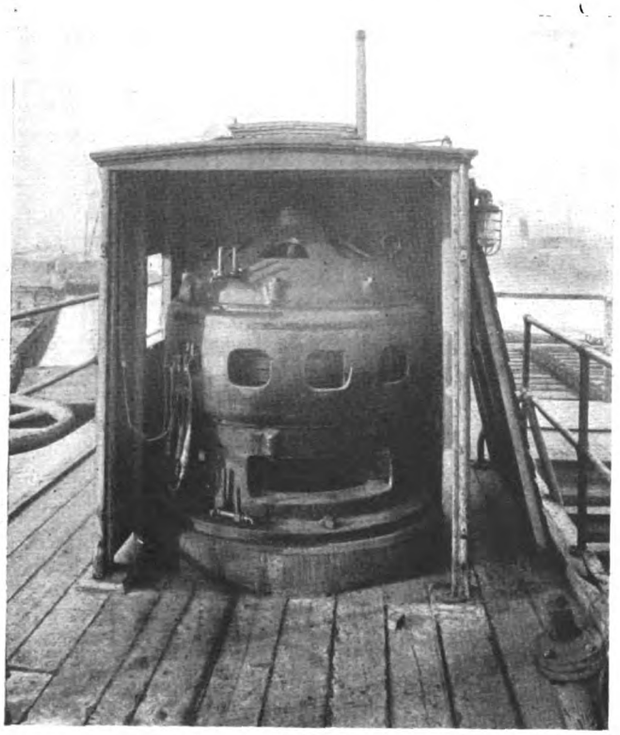
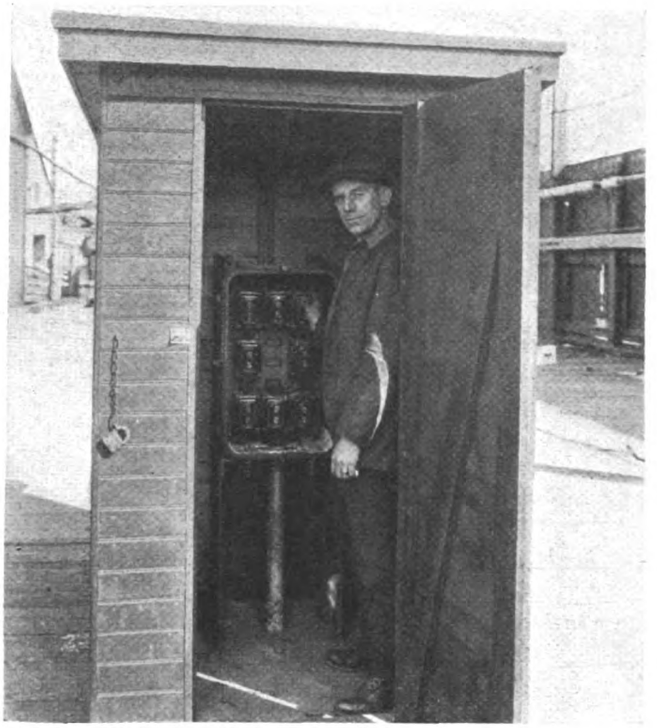


One of Eight 125-Horsepower Motors Operating the Pumps



Dock Master's Push Button Control Station

from one to eight, and each controls one of the eight pump motors in the dock.

To start any or all of the motors, the dock master presses the proper "start" buttons; to stop them, he presses the "stop" buttons. Thus the control of the delicate operation of pumping out a dock is literally at his finger tips, and his days of bawling out orders, with the consequent loss of time and possibility of being misunderstood, are at an end.

This is one of the first instances of automatic electrical control of a dry dock, although this system has been successfully used in other industries, notably in steel mills, for many years.

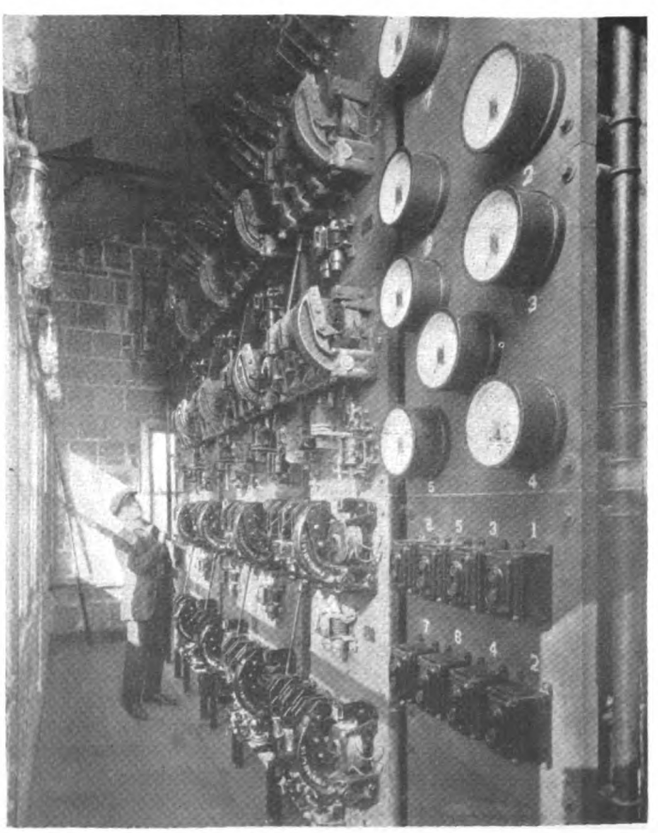
The Controller

The controller itself is located in the yard's substation. This consists of a large panel board carrying eight groups of magnetic contactors, eight ammeters, and eight sets of push buttons, which are duplicates of those in the dock control house. The actual motor connections are made by the contactors (and not by the push buttons), and these are so designed that they close in the proper order and at a rate that will start the motors in the least possible time consistent with safety.

The motors operate on 3-phase, 25-cycle, 440-volt current but are started by being connected with a 220-volt circuit. When the dock master presses the "start" button of No. 1 motor, for example, the contactors are energized and those that connect it to the 220-volt circuit close first. This application of low-voltage current starts the motor easily and brings it gradually up to speed. When the proper speed is attained, a relay mounted on the panel closes automatically, and the 440-volt contactors then close, connecting the motor directly to the running circuit. When the "stop" button is pushed, all contactors open and disconnect the motor.

The ammeters mounted on the control panel give the electrician in charge of the substation complete information as to the performance of the motors. By glancing at these instruments, he is able to determine whether or not each motor in operation is taking its full share of the load. Any irregularities indicated are immediately investigated, and troubles can often be remedied before actually developing

The duplicate set of push buttons in the substation provides control of the motors in case of trouble at the dock house, and also permits the electrician to act in case of an emergency.



Magnetic Contactors in the Yard Sub-Station. At the Right Are the Ammeters, Showing Operating Conditions of Each Motor; Below Them Is the Duplicate Set of Push Buttons

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The motors are of the vertical squirrel cage type and are rated at 125 horsepower at 290 revolutions per minute. They are provided with ball thrust bearings and their coils are impregnated to render them weatherproof. They are mounted in little houses on the deck of the dock, and each is directly connected to an Alberger centrifugal pump.

Current for this installation is received from the Brooklyn Edison Company at 6,600 volts and is stepped down to 440/220 volts by three oil-insulated self-cooled transformers.

The dock itself cost over $1,000,000 and all of the wooden construction was handled by the yard. The marine construction engineer in charge was Henry J. Gielow of New York. All of the electrical equipment was supplied by the Westinghouse Electric & Manufacturing Company.

The Most Interesting Job in the Yard

If you are holding down an interesting job in a shipyard, have you become so absorbed in your own work that you have failed to realize the importance of the work in some of the other departments in the yard? Even if you haven't, it is more than likely that many of the men in the other departments have, and that, through ignorance or indifference, they know little about your job or its importance. Here is a chance for you to tell them, as a loftsman is doing in the letter printed below, and as others have done in previous issues, why yours is the most interesting job in the yard. Who's next!

WHILE I am willing to acknowledge, when merely thinking is concerned, that the draftsman has "the most interesting job in the yard," I will not readily hand him the palm when it is a question of both thinking and acting. It then rightly belongs to the mold loftsman. Being a loftsman by trade, I am ready to defend the attributes of this vocation against all who may be skilled artisans in the marine engineering industry. Yes, even against those literati of the industry who use Latin in their discourses!

The loftsman dwells in an atmosphere of romance as well as accomplishment. Twenty-two years ago a group of American bridge builders began the task of building a ship at Camden, N. J. Confronted with the archaic British method of ship construction these gentlemen asked themselves why a ship could not be built as they had been building bridges. Thus, American inventive genius germinated the idea that has wrought a revolution in shipbuilding. Here, too, the fabricated ship was given birth, with the death-knell being sounded in America to the supremacy of old-world methods as well as old-world shipbuilders. The problems of a ship were found to be vastly different from those of a bridge; but fortitude and determination triumphed. Today the solution of all these difficulties is known to the modern loftsman, even though some are termed "impossible" by classics of the foreign shipbuilding technical world.

Revolution in Shipbuilding Began in the Mold Loft

Formerly the speed of ship construction was governed by the output of the punch shed which in turn relied on steel that had been templeted from the ship, a la the old scriveboard method. Today the mold loft can turn out a ship and keep three shifts going in the punch shed with three shifts of plate-hangers, if need be. The speed of ship construction at present depends, in the main, on bolting and riveting.

Here in the Pacific Northwest—even today a pioneer country—is a shipbuilding establishment (Skinner and Eddy Company, Seattle, Wash.) that made and held all records, during the late crisis, for fast ship construction. The factors entering into this achievement were: an efficient business organization; a capable and energetic works manager; a body of loyal workingmen; and a modern mold loft system. Even though the other factors were double as able, without the loftsman's valuable service no records would have been possible; for Britain, with her age-old family of shipbuilders, would easily have outstripped them. To the skilled art of the loftsman as to no other single factor—aside from the demand—goes the credit of shipbuilding in America emerging from 85th place in American industries in 1914 to 15th place in 1920, thus making us the shipbuilding nation of the world.

What the Loftsman Does

A skeleton outline of a loftsman's duties should convince the most skeptical of the merits of my claim. After the inspired genius of the drafting room has completed the ship's form to a ¼-inch scale, it is sent to the loftsman who lays the design down on the mold loft floor to full size. Working to measurements forty-eight times greater than the draftsman, the loftsman is enabled to round off unsightly corners, thus assuring a finished ship that will be fair and pleasing to the eye. With the completion of the lines, work is begun templeting the various constructional parts such as the frames, bulkheads, decks, shell, foundations, hatches, masts, etc. A paper or wooden templet is made to exact size for each piece of steel that enters into the hull of the ship, ranging from the largest shell plate to the smallest liner. While some parts are flat and some curved, a considerable amount is also twisted, testing severely both the skill and imagination of the loftsman. As all this work is laid out on the flat—in one plane—and although many checks as to its accuracy are applied, the actual success can be known only after fabrication and erection. The responsibility involved in the undertaking is a large one; but results, in percentage of error, show that the loftsman still remains, by a narrow margin, a member of human-kind.

Coincident with the templet work the loftsman provides the ship carpenter with molds enabling him to prepare the building slip for keel laying, stage building, etc. Later assistance is given in launching preparations when the steel poppets and tie plates for sliding ways are made.

The Loftsman's Directions Are Followed in Fabricating and Erecting the Ship

The work of the fabricating shop is carried on as directions of the loftsman indicate, with the following operations being performed on his orders: duplicating mold on steel, punching, shearing, planing, countersinking, knuckling, flanging, rolling, coping, slotting, drilling, chipping, calking, tapping, sawing, burning and welding. The frame bender is materially aided in all work under his care and the plate-furnaceman as well. The anglesmith staples, offsets, box-ends, etc., from molds supplied by the loft, and the solid-smith works flats and rounds, if need be. Even the heavy forger is aided when the occasion demands it.

The plate-hangers' job is now one of comparative ease as

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the loftsman, by cutting, arranging and planning, has facilitated the easy shipping of steel. While the calkers and test-gang can make any tank, whether air, oil or water, tight with the aid of a red-lead gun, taps, steel shims, wedges and packing, the loftsman's accurate work has caused this practise to be well-nigh a lost art. In days of old the job of plating the shell of a ship was a nightmare; but, due directly to the loftsman, it is now quite a simple task, the hardest job at present being to secure good shell riveters. On all kinds of hull repairs the loftsman has lately left his mark, having made possible some of the quickest, most economical and largest repairs.

The patternmaker finds the loftsman indispensable on such work as stems, sternposts, sea chests, hawse pipes, bollards, chocks, torpedo tubes, spectacle frames, etc. The inside machinist following closely behind is also aided along these lines. The joiner has recourse to the loft on such work as pilot houses, cabins and quarters. It is thus, too, with the sheet metal worker who is assisted on light-gage bulkheads, ventilation, etc. Cooperation is extended to the boiler maker on condenser and boiler foundations, and in some yards the loftsman lays out uptakes, smokestacks, feed and filter, fresh water, gravity and sanitary tanks of all kinds. Out on the ship the loftsman assists the outside machinist in locating the position of pumps, engines and propeller shafting for boring. For the painter the freeboard marking, paint lines and draft marks are located. Incidentally, any work on board the ship entailing a knowledge of geometrical construction is performed by the loftsman.

The Language of the Blueprint

My contemporary, the draftsman, states that all "Nulli Secundus" has left to do is to "read the plan," which would be a simple matter, if it were on a par with reading Greek or Chinese for instance; then, when errors arose, they could be proved by the known laws of grammar. However, the language of the blueprint is not yet an exact science, all of which is known to the draftsman and offers him a nice loophole for escape when controversies arise. Even though it were, I believe that some of the more astute wielders of the right-line pen would claim the disputed points to be idioms, not readily understood by the yard force.

Hull construction foremen and superintendents possess a valued stock in trade called executive ability; but it will be found that this quantity—however elusive and intangible—varies in proportion to the very "practical" accomplishments of the yard's mold loft. The ratio would probably be thus: executive ability varies inversely to the cube as does the inefficiency of the mold loft directly to the square.

The Mold Loft a Clearing House of Information for the Whole Yard

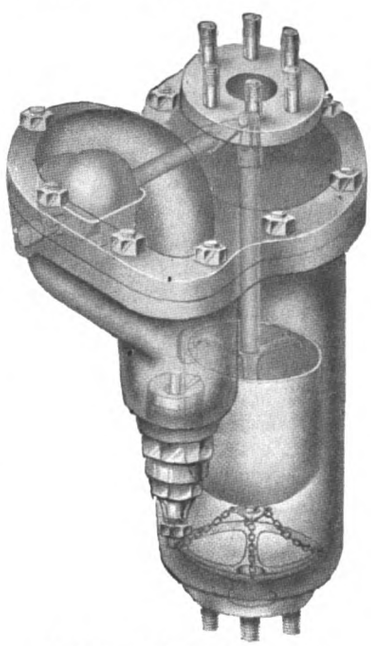
The mold loft is now a clearing house of information for the whole yard and the perfecting of the modern loft is the result of the cumulative effort of the men comprising its personnel, aided and encouraged by executives of vision. Unobtrusive perhaps the loftsman may be, and little seen or heard, yet his is a humility born of greatness. The multiple punch has tended to detract somewhat from his laurels and further inroads may be made with the perfecting of the welded ship; but in this march of progress the loftsman joins; for having in the past been a trail blazer he can still be found adapting himself to changed conditions and ever being a member of the vanguard of progress.

Seattle, Wash. Angus D. MacDonnell.

Shipping Board's Operating Loss in February.—The loss of the operating department of the Shipping Board for the month of February was reduced to $3,089,459, according to an announcement by Chairman Lasker. This was the best showing the board has yet made for any month. When the present board took office last year the average losses were between $11,000,000 and $12,000,000 a month. About 400 ships are now in operation, which is less than were being operated at that time, but freight rates are lower than then and the board is covering all trade routes. For January the operating loss was $3,445,447. The loss for February includes $593,290 on voyage operations. The tankers alone earned a profit of $534,481; charter hire amounted to $65,411; cost of repairs to $1,050,000; lay-up expenses to $413,076; insurance premiums to $320,355; salaries and wages to $477,546, and general expenses to $300,000. The board is not yet making public a detailed statement because it is still experimenting to ascertain the proper reserves to be used and it is stated that the loss might possibly be increased by some $400,000 if the reserve set up for repairs proves inadequate.

Automatic Oil Shut-Off for Oil-Fired Boilers

With the increased use of oil as a fuel aboard ship the necessity of providing an automatic check to the fuel feed in cases of low water in the boilers caused the Todd Shipyards Corporation, New York, to develop a device known as the Todd "Guardian" to eliminate this cause of danger in the boiler room of a steamship.



Safety Fuel Feed Shut-off

The device is operated solely by the changes in water level in a boiler which act on a bucket float partly filled with water suspended in one chamber of the apparatus. This float, as will be seen in the accompanying phantom sketch, is arranged with an anchor and chain suspension, which keeps it from touching the sides of the chamber. In addition to the float chamber, a similar chamber is cast in the body of the device at the top in which a cradle containing a steel ball is placed. The float bucket and cradle are connected by means of a rocker arm and spindle. The steam connection is at the top of the chamber and the water connection at the bottom.

When the water level in the boiler falls, it also drops in the float chamber until the danger level is reached, at which point the weight of water in the bucket produces a strong downward pull on the spindle connecting the cradle. This action of the spindle tips the cradle sufficiently to roll the ball from its place whence it drops on the ram head of a cartridge placed in the bottom of the chamber. The ram has a peculiarly shaped point which perforates a copper disk and allows the steam to escape through the opening thus made. This steam enters a stop valve above the diaphragm which automatically shuts off the oil fuel supply to the burners.

The cartridge is a complete unit in itself and can be inserted after the device has functioned. Before it is put in place, however, the ball must be pushed back into the cradle by means of a rod.

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Cement and Concrete for Shipbuilding Purposes

By Horace Holden Thayer *

Continuation of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials' point of view.

WHEN the word "cement" is used without qualifying adjectives in connection with shipbuilding work, it is generally understood to be a mixture of Portland cement, sand and water which might more properly be called Portland cement mortar. Concrete is invariably such a mixture together with coke or other so called coarse aggregate. A few special cements which may properly be considered in this article will be dealt with at the end of the article.

Tentative standard specifications have been prepared and submitted as a progress report by a joint committee on standard specifications for concrete and reinforced concrete made up of representatives of the American Society of Civil Engineers, American Society for Testing Materials, American Railway Engineering Association, American Concrete Institute and the Portland Cement Association. When these specifications are hereinafter referred to they will be called "Tentative Standard Specifications."

The Concrete Ship Section of the United States Shipping Board Emergency Fleet Corporation, working in close collaboration with the United States Bureau of Standards did a vast amount of research and experimental work necessitated by the concrete ship construction program. When reference is made to their work or the results obtained from it they will be called, for short, the "Shipping Board."

Nature of Cement and Concrete

The Portland cement in cement and concrete mixtures is partly dissolved by the water and partly held suspended in the solution. It passes through a succession of chemical reactions and eventually begins to set by the formation of interlocking crystals and by the development of colloids or glue like masses. These crystals and colloids acting by themselves have comparatively little strength but when acting as a binder between the particles of sand in cement or as an active part of this cement in the voids of the coarse aggregate of concrete, they develop great cohesive and adhesive power and form an artificial stone.

Reinforced concrete is not rigid but is quite elastic within a moderate range. It is not brittle and is most difficult to break up. Local shocks may puncture it if heavy enough and heavy shocks may cause cracks, but these do not destroy the efficiency of the concrete as a whole. Concrete itself apart from any free alkali content is not affected by sea water.

The proportions of the different elements in concrete have been pretty well standardized for ordinary practice, but for special work like the construction of concrete vessels, which requires maximum strength and density, accurate tests should be made of any new product as well as of the materials. The latter should be selected, graded and proportioned so that the number and size of the voids will be reduced to a minimum. There should be sufficient Portland cement to thoroughly coat every particle of sand and coarse aggregate and to fill all voids between the particles of sand; there should be sufficient sand to form with the Portland cement and water an amount of mortar slightly in excess of that required to fill all the voids between the pieces of coarse aggregate; and there should be only sufficient water used to hydrate the Portland cement, to take care of all possible absorption of water by the dry aggregate and to render the entire mass sufficiently plastic to compact itself and to readily adjust itself to the forms.

Uses of Cement

Cement is a valuable product on shipboard. Some of its uses have been already referred to. The more important of them may be tabulated as follows:

Deck covering.
Base for other deck coverings.
In the bottom of steel ships, including the lower turn of the bilge, efficiently covering the plates, frames and rivet heads. This is a classification society requirement.
Between floors in peaks and bilges to avoid water pockets below drainage holes.
Temporary repairs on all ships.
Inside of fresh water tanks.
Cement wash in tanks and double bottom compartments which do not carry oil.
Cement powder dusted into liquid tar on tank tops.
On tank tops.
Under and in front of boilers.
Calking material.
To stop local corrosion.

Uses of Concrete

Concrete is of particular value only for the construction of concrete ships; though it is used on other ships where considerable volumes of material have to be filled in, such as between floors in the peaks, where a saving in weight or cost can be effected by using it instead of cement.

Portland Cement

Portland cement is defined by the American Society for Testing Materials as the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination excepting water and calcined or uncalcined gypsum. A free translation of the foregoing is that shale or cement rock with limestone and possibly a little earth are mixed in the proper proportions to produce the desired material and roasted in rotary kilns. A little gypsum, not over 3 percent, may be added to regulate the setting action. The fused material is ground to a fine powder, which powder is Portland cement.

Very complete and detailed specifications for this material and the methods of determining its properties have been adopted by the American Society for Testing Materials as their Standard specification C9-21, and they have also been made a part of the Tentative Standard Specifications, and been made the standard of the Navy Department, the American Engineering Standards Committee, and other bodies. The requirements of these specifications, which illustrate the essential qualifications of the material, are:

Chemical Limits

The following limits shall not be exceeded:

Loss on ignition, percent	4.00

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

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Insoluble residue, percent	0.85
Sulphuric anhydride (SO_3), percent	2.00
Magnesia (MgO), percent	5.00

SPECIFIC GRAVITY

The specific gravity of cement shall be not less than 3.10 (3.07 for white Portland cement). Should the test of cement as received fall below this requirement, a second test may be made upon an ignited sample. The specific gravity test will not be made unless specifically ordered.

FINENESS

The residue on a standard No. 200 sieve shall not exceed 22 percent by weight.

SOUNDNESS

A pat of neat cement shall remain firm and hard and show no signs of distortion, cracking, checking or disintegration in the steam test for soundness.

TIME OF SETTING

The cement shall not develop initial set in less than 45 minutes when the Vicat needle is used or 60 minutes when the Gillmore needle is used. Final set shall be attained within 10 hours.

TENSILE STRENGTH

The average tensile strength in pounds per square inch of not less than three standard mortar briquettes composed of 1 part cement and 3 parts standard sand, by weight, shall be equal to or higher than the following:

Age at test, days	Storage of briquettes	Tensile strength, pounds per square inch
7	1 day in moist air, 6 days in water	200
28	1 day in moist air, 27 days in water	300

The average tensile strength of standard mortar at 28 days shall be higher than the strength at 7 days.

The Navy Department specifications are identical with specifications C9-21 of the American Society for Testing Materials, except that the Navy Department has inserted a sentence in the part of the specifications dealing with the determination of fineness which states that no greater amount of residue on a No. 200 sieve than the above mentioned 22 percent will be allowed.

The Shipping Board specified a more finely ground Portland cement, thereby enabling the production of a more plastic concrete and one subject to less change in volume than when Portland cement of the normal fineness is used. Their specifications require 90 percent to pass a standard No. 200 sieve.

This is probably a good place to state that standard sieves are based on a "Table of Fundamental Data on Standard Specifications for Sieves" issued by the Bureau of Standards in 1920; that they have square openings; that for sieve sizes ⅜ inch and larger the size is the size of the opening; and that the number given to the smaller sieves is the standard number of wires per inch, and the approximate openings and wire diameters in inches are as follows:

	Sieve Opening	Diam. of Wire
200	.003	.002
100	.006	.004
50	.012	.008
30	.02	.013
20	.0335	.0165
16	.0412	.0213
8	.092	.033
4	.20	.05

SAND

The sand or fine aggregate used in cement and concrete must be sharp. Seashore sand will not answer as the particles are worn round and smooth by the action of the water. The sand may be either natural siliceous sand or screenings from crushed quartzite or equally hard rock. It should be well graded and free from dust, clay and other deleterious matter. The Navy Department requirements for sand are that the sand used shall be clean and sharp and shall be such as to pass through a No. 20 sand sieve, and be retained on a No. 30 sieve, the sieves to conform to the standard sieve specifications of the Bureau of Standards; and that sand having passed the No. 20 sieve shall be considered standard when not more than 2 grams pass the No. 30 sieve after one minute continuous sifting of a 200-gram sample.

The Tentative Standard Specifications state that it shall range from fine to coarse and be preferably within the following limits:

Passing through No. 4 sieve	not less than 95 percent.
Passing through No. 50 sieve	not more than 30 percent.
Weight removed by decantation	not more than 3 percent.

They also state that the fine aggregate shall preferably be of such a quality that mortar briquettes, cylinders, or prisms, consisting of one part by weight of Portland cement and three parts by weight of fine aggregate, mixed and tested in accordance with the methods described in the "Standard Specifications and Tests for Portland Cement," will show a tensile or compressive strength at ages of 7 and 28 days not less than that of 1:3 standard Ottawa sand mortar of the same plasticity made with the same cement. However, fine aggregate which fails to meet this requirement may be used, provided the proportions of cement, fine aggregate, coarse aggregate and water are such as to produce concrete of the strength specified.

The standard Ottawa sand referred to is natural sand mined at Ottawa, Ill., screened to pass a No. 20 sieve and retained on a No. 30 sieve. It is the sand that is standard for use when testing Portland cement.

The Shipping Board requirement was that the fine aggregate when dry should pass a standard 3/16 inch mesh screen.

COARSE AGGREGATE

The usual requirements for the coarse aggregate are that it will be crushed stone, gravel or similar inert material, clean, hard, strong and durable, and free from soft, flat or elongated particles, or alkali, organic or other deleterious matter. Stone and gravel are, however, too heavy for shipboard service.

Coke is a good material when the concrete is used for filling in between floors in vessels and similar service. The Navy Department allows the use of coke crushed to small size where such filling has a depth over 3 inches. They require that a thin coat of cement mortar about one inch thick be first put on; then that the space to be protected be filled with fine coke and a cement mortar grout be poured over it filling the voids; and finally that it be finished off with a 1-inch coat of fresh mixed cement mortar sufficiently stiff to be trowelled to a surface. This is a good procedure to adopt generally.

As weight is one of the great handicaps of a concrete ship, it is essential that the coarse aggregate be as light as possible while still giving the concrete the necessary strength and impermeability. The Shipping Board developed an aggregate of bloated clay which floats on water. Concrete made of it weighs less than 110 pounds per cubic foot, which is 20 percent less than that obtained from normal sand and gravel aggregates. In addition to the light weight it has great strength, giving in excess of 4,000 pounds per square inch (in 28 days) in mixtures required in ship construction as compared with 2,000 pounds per square inch for much of the concrete used in ordinary building construction. This aggregate also makes a concrete having an impermeability equal to or greater than with sand and gravel aggregates.

The size of coarse aggregate depends upon the character of the work and no attempt is made in the Tentative Standard Specifications to specify it except to define it as aggregate that is retained on a No. 4 sieve, and of a maximum size generally not larger than 3 inches and to limit the amount that will pass a No. 4 sieve to not over 15 percent and the amount that will pass a No. 8 sieve to not over 5 percent. In the Shipping Board's concrete ships, the coarse aggregate when dry was required to pass a sieve having ⅜ inch square openings, and to be retained on a sieve having 3/16 inch round openings.

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WATER

The water used in making cement and concrete should be clean, preferably of drinking quality, and free from oil and alkali or other deleterious substances. The Shipping Board required samples to be submitted for their approval.

The amount of water used in making concrete is an important factor. There should be sufficient to take care of the duties previously mentioned and, with these taken care of, the less excess water the better. With too much water the crystallization of the Portland cement may be incomplete and the slower hydration into colloid forms be badly affected. An excess of water tends to prevent the deposit of a uniform film of the hydrating cement on all surfaces of the aggregates and tends to allow the larger and heavier pieces of aggregate to sink to the bottom, where they form a definite stratum poorly connected together and often so full of voids as to provide easy passage to percolating water. With very wet mixtures any fine sand or dirt will flow to the surfaces and into the corners and result in crazing and cracking. An excessive use of water is particularly serious in concrete for shipbuilding purposes because the porosity of concrete results to a considerable extent from the leaching out or evaporation of excess water; the greater the amount of water, the greater the volume of the pores or voids, both strength and permeability being thus affected.

It has been proven that the strength of concrete decreases rapidly when the water content is increased beyond a certain point. This point for any particular mixture is difficult to determine exactly on account of the great variation in absorptive properties of the aggregates, even when from the same source. The Bureau of Standards has compiled a great deal of information regarding this in their Technologic Paper No. 58, on the "Strength and Other Properties of Concrete as Affected by Materials and Methods of Preparation." They show that a gravel concrete requires less water than a crushed sandstone concrete, and a crushed granite concrete requires less than either. They conducted a large number of compression tests in which aggregates from many sources were used in varying proportions, with a measured water content modified as required by the differing coefficients of absorption of the aggregates to produce mixes of certain consistencies, of which the three most commonly used are defined by them as follows:

Quaking—A stiff mixture upon which water can be brought to the surface by slight tamping. The mass should not flow readily.

Mushy—A soft, mushy mixture which is not watery, but can be spaded and readily worked into place in the form.

Fluid—A watery mixture which flows readily into place in the form with little or no working.

Typical figures from these tests, made with small cylinders of one color, two colors and four colors, mixes of crushed granite and of gravel concretes are:

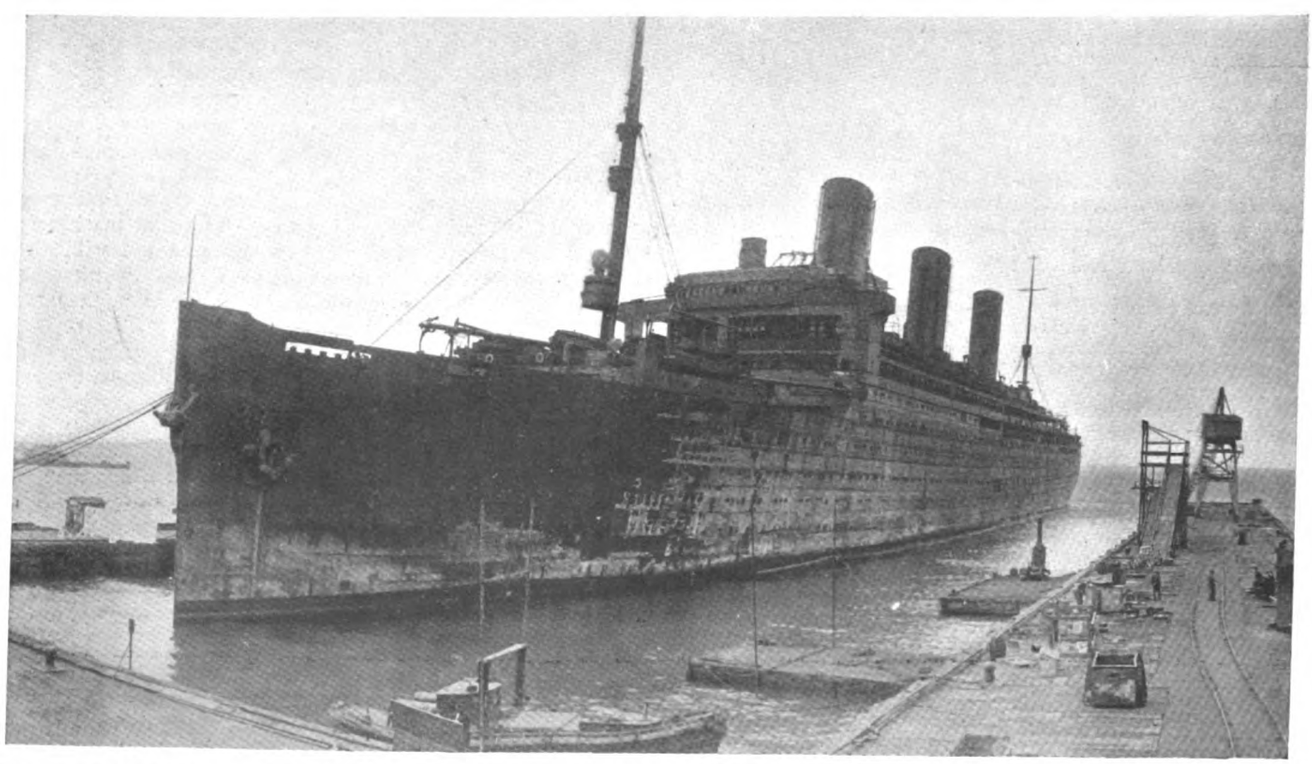
Ultimate Stress in Pounds per square inch
Crushed Granite
Concretes

Consistency	*Fluid*	*Mushy*	*Quaky*
Percent water	9.0	8.0	6.9
Age—4 weeks	2683	3480	4000
Percent water	9.0	8.4	7.0
Age—52 weeks	4908	5299	6278

The tests revealed almost without exception that the quaking and mushy consistencies gave the greater strength, the former, in all but a few cases, giving better results than the latter, while the fluid or watery mix made a comparatively poor showing.

In the report accompanying the records of the tests, it is stated that the most satisfactory consistencies of concrete, from the standpoint of strength and durability, are the quaking and mushy mixtures and the error should be made

(*Continued on page 336*)



Steamship Leviathan as She Appears in Her Berth at the Yard of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va.

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Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in This Department

Conducted by James L. Bates

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Design of Hand Gear for Steam or Electro-Hydraulic Steering Machinery

Q. (1154).—When designing a hand gear for a steam or hydraulic-electric steering gear, what is the ratio of power required to that of the main gear? In other words, how many pounds pull and at what speed should it be applied to the hand wheels? How long should it take the hand gear to pull the rudder from hard over to hard over in the event of the main gear having broken down? Are there any books or pamphlets published dealing with the design of deck machinery?

A. (1154).—The following tabulated data will, it is thought, answer your questions better than a more general discussion:

	No. 1	No. 2
Type of ship	Passenger	Tug
Displacement in tons	10,000 to 12,000	200 to 225
Length in feet	460	85
Speed in knots, when hand steered	about 10½	9 to 10
Number of men at hand wheels (total)	6	1
Number of hand wheels	3	1
Type of main steering gear	electric screw	hand
Diameter of hand wheel to center of grips, inches	72	48
Diameter of rope drum, if fitted, inches	..	6
Hand gear connection to main driving shaft	clutched direct	..
Screw gear, double acting	7¼" outside dia., 1½" lead	..
Radius of rudder crosshead or tiller, inches	28	54
Pounds pressure at steering wheel per man	allowed 30	**28 by test
Type of rudder	single plate, unbalanced	wood unbalanced
Rudder area in square feet	157	33½
Width of rudder in fore and aft direction, inches	111	51
Number of turns of hand wheel, hard over to hard over	..	4¾
Time, hard over to hard over	*90 seconds	..

For comparative purposes the following may be of value:

Kent's handbook gives for a man turning a crank or winch as follows:

R = resistance in lbs.	12.5	18	20
V = ft. per sec.	5	2.5	14.4
T = hours per day	..	8	2 minutes
RV = ft. lbs. per sec.	62.5	45	288
RVT = ft. lbs. per day	..	1,296,000	..

Smeaton is authority for the following: "A man draws horizontally 70 to 80 pounds, and thrusts at the height of his chest 28 or 30 pounds. . . . The force of a man in turning a winch is taken at 116 pounds."

I am unable to refer you to a book on deck machinery. I should say that conscientious study of the principles of machine design as applied to the design of the different types of deck machinery for which you might be able to secure detailed information from the manufacturer is about the only course open to you.

*This is an extreme arc of 35 degrees from about 20 degrees one side of center line to 15 degrees the other, it being impracticable to obtain more with the hand gear.

**This was found too great for satisfactory continuous operation. It was reduced to about 18 pounds by the introduction of a 2 part purchase in each tiller lead.

Metacentric Height and Freeboard for a Tug

Q. (1155).—Do you consider 18 inches of metacentric height sufficient for a tug? Is 2 feet of freeboard enough?

A. (1155).—It is assumed from the figures given that you have in mind a harbor tug, steam driven, and from 85 to 100 feet in length. Of ten such tugs, for which the writer has reliable data, the metacentric heights are generally in excess of 15 inches, ship light, and from 18 to 30 inches, ship in loaded condition. The freeboards of these tugs at the half length are, in the loaded condition, generally in excess of one foot, while in the normal service condition they approach two feet.

The real criterion is not either metacentric height or freeboard taken individually. It is rather a composite of the value of the maximum righting, the angle of heel at which it occurs and the maximum range of stability. For tugs of the type in question a maximum righting arm of 0.6 to 0.8 foot, occurring at from 25 to 35 degrees angle of heel and a maximum range of stability of at least 50 degrees, all in the normal or service condition, should give satisfactory results.

Weights of Auxiliary Machinery

Q. (1163).—Will you please give separate formulas for determining the weight wet and dry of each of the following auxiliary engines: Condenser, heater, air pump, feed pump, etc. Also for the weight of the following machines: Lathe, planing machine, slotting machine, motor, drilling machine, etc.?

A. (1163).—The writer is unable to answer this question as fully as he would like, owing to the fact that machinery weight estimates are usually determined where possible by comparison with data already at hand of similar units; or, where information is not available for comparison, they are usually obtained from the manufacturers.

It would be impossible to derive formulas which would cover condensers as a class, owing to the fact that the type of vessel upon which they are to be installed generally governs their design as to form and lightness. What has been said of condensers also applies to other units.

The following are a few approximate rules which may be used for weight estimates:

	Dry	Wet
Condensers, shell, of plate construction.		
Heavy naval and merchant marine, pounds per square foot	5 to 6	6 to 7
Auxiliary condensers	5½ to 6½	6¼ to 7¼
Light fast craft	3½ to 4	4¼ to 4¾
Feed water heaters, shell, of plate construction.		
Coil type, pounds per square foot, dry	= 12	
Film type, pounds per square foot, dry	= 24	
Straight tube type, pounds per square foot	= 5 to 6½	

Air Pumps: For dry weight allow about 480 pounds per cubic foot of volume swept through by all pistons; i. e., 480 times the total area corresponding to the diameters of all pistons multiplied by the length of stroke.

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LETTERS TO THE EDITOR

Diesel Electric Propulsion Versus Direct Drive

The article appearing in your February issue by Commander S. M. Robinson entitled "Diesel Electric Propulsion of Ships" has been read with much interest, as this subject is at present keenly discussed in this country, and pronouncements from brother engineers in the States are given close attention.

While in the main, the views of the author appear to be substantially the same as those of the leading engineers here, there are some statements made with which agreement cannot be expressed, and this letter is written with the object of obtaining further elucidation as to what is in the author's mind.

The statement that the Diesel is inherently poor in maneuvering qualities is far too sweeping an assertion to make and, while this reproach may be leveled at some designs, yet in the type built by my firm, Messrs. William Beardmore & Company, Dalmuir, Scotland, i.e., the Beardmore-Tosi four-stroke engine, these qualities of maneuverability and flexibility excel those of a steam engine. In the motorship *Pinzon,* recently completed—a single screw ship of 1,200 brake horsepower—the response to an intensive series of 85 telegraph orders was perfect. In this engine the speed can be reduced without misfiring to one-fifth of the designed full speed. While it is quite true that air must be used for this purpose, yet, it is not clear why air at 350 pounds per square inch pressure should be "not only entirely unsatisfactory, but distinctly bad," while injection air at 1,000 pounds is—except in the case of the few solid injection engines—essential for the operation of the engine at all, whether driving a generator or a propeller. While it is admitted that air starting bottles may be dispensed with, injection air bottles still remain.

It is agreed that the higher the speed of revolution, the more efficient the engine as a prime mover for driving generators becomes, but it is undoubtedly a fact that the fast running engines driving dynamos in present motorships give infinitely more trouble in their maintenance than the relatively slow moving main propelling units, and there is a general tendency in this country to limit the speed of such machines to 250 revolutions per minute. (With a multiplicity of these small fast running units installed in a high powered ship, the lot of the engineer would scarcely be enviable.)

Commander Robinson quotes an example of a 2,000 shaft horsepower ship driven by twin Diesels at 150 revolutions per minute, but such a practice is practically unheard of over here, the figure being usually 110 to 120, which with a twin screw vessel does not mean excessive loss of propeller efficiency, whereas a 2,000 horsepower motor running at 90 revolutions per minute is an enormous and costly item and provides no stand-by in case of disablement.

In discussing the choice of current, Commander Robinson's remarks regarding the use of series coupled direct current machines are quite concurred in but, so far, it does not appear that a case for alternating current for any ship of the powers at present suitable for Diesel electric drive can be made out. The necessity for extremely close governing and the maintenance of the propelling motors at a speed corresponding to the periodicity, irrespective of the fact that the alternator is essentially a machine more suitable for running at thousands of revolutions rather than hundreds, would put this type quite out of the running as a commercial proposition.

The statement that the Diesel electric drive would be suitable for installation in the Emergency Fleet Corporation ships with a resulting fuel consumption of one-third of the present figure seems to be open to question. It is highly improbable that this drive could be accomplished under 0.5 to 0.6 pound per shaft horsepower hour, so that if the existing turbine plant utilizes three times this amount, i.e., 1.5 to 1.8 pounds of oil, then there is something radically wrong with the present equipment.

For double purpose, vessels of moderate power, such as trawlers, cable steamers, ferryboats and, in some cases, yachts, the Diesel electric drive is ideal, the sole detriment being its first cost, but for very high powers, e.g., the 48,000 horsepower design shown for a capital ship, it is quite outside the range of practical possibilities at the moment. A six cylinder engine developing 1,000 brake horsepower per cylinder is still in the future. It is doubtful if any navy would risk installing such an equipment without cautiously feeling its way through the more moderate powers at present successfully tried out, i.e., say 300 horsepower per cylinder.

Commander Robinson closes with the truly amazing statement that the crosshead engine is still in its infancy! He does not appear to realize the limitations of this method of propulsion—excellent though it is in many cases—and would seem to be imbued with the conviction that the system is the one solution for all classes of ships' machinery.

R. J. BUTLER, M. I. N. A.
Messrs. William Beardmore and Company
Dalmuir, Scotland

Commander Robinson Replies

I have noted the criticism of Mr. Butler, of Messrs. William Beardmore & Company, on my article appearing in the February issue of your publication. Some of these criticisms relate to points on which views must necessarily be merely matters of opinion but others cover points which it would seem that data now available are sufficient to cover and consequently I would like to reply to the criticism on these points.

The first point raised is in connection with the maneuvering qualities of Diesel engines. I think Mr. Butler missed the point of my article in this connection. It is, of course, a well-known fact that Diesel engines can be built which can be maneuvered by the use of air, but it seems to be also a well established fact that such engines have to be built extremely heavy to take care of the stresses set up by this method of control and, if the Diesel engine is to progress and be built in large sizes for marine purposes, it would seem that some other solution rather than air for maneuvering must be found. Mr. Butler makes the point that it is necessary to use air at 1,000 pounds for injection at all times and, therefore, the use of air at 350 pounds for maneuvering should cause no ill effects. I must confess I cannot see the connection between the use of air for injection and the use of air in the cylinders for maneuvering.

In regard to the use of single screws and twin screws, Mr. Butler makes the point that single screws provide no standby in case of disablement. The answer to this is that up to the advent of the Diesel engine practically all cargo ships were built with a single screw, and this seemed to provide sufficient reliability. If electric propulsion is used for a single screw, it would always be desirable to provide two motors for the shaft so that duplication would be provided so far as the machinery is concerned. As regards the comparative efficiencies of single screws and twin screws, assuming the latter can be operated at the most efficient speed, the arguments all seem to be against the twin screws in spite of the data that have been appearing on this subject recently. It is significant that until ships began to be propelled by Diesel engines no one questioned the superiority of the single screw for propulsion purposes.

Exception has been taken to the statement in my paper that a crosshead engine can almost be said to be still in its

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infancy. The intent of this statement was apparently entirely misunderstood. It was not intended to convey the impression that reliable crosshead engines were not being built at the present time—in other words, the infant is quite strong and sturdy—but it was intended to mean that the probable development of large Diesel engines will be by the use of this type of engine.

Bureau of Engineering,
Navy Department,
Washington, D. C.

S. M. ROBINSON,
Commander, U.S.N.

Cement and Concrete for Shipbuilding Purposes

(*Continued from page 333*)

on the side of using too little rather than too much water, providing the concrete is properly spaded or worked into place in the forms.

Some of the valuable conclusions derived by the Bureau of Standards from these tests are:

"A concrete having a desired compressive strength is not necessarily guaranteed by a specification requiring only the use of certain types of materials in stated proportions. Only a fractional part of the desired strength may be obtained unless other factors are controlled.

"The compressive strength of a concrete is just as much dependent upon other factors, such as careful workmanship and the use of the proper quantity of water in mixing the concrete, as it is upon the use of the proper quantity of cement.

"The compressive strength of concrete may be reduced by the use of an excess of water in mixing to a fractional part of that which it should attain with the same materials. Too much emphasis cannot be placed upon the injurious effect of the use of excessive quantities of water in mixing concrete."

(*To be continued*)

PERSONAL MENTION

A. P. HAMMOND has been selected as Pacific coast manager of the Atlantic Gulf & Pacific Steamship Company.

FRANK J. SKALA has been made general western agent for the United States Lines. Mr. Skala will have his headquarters in Chicago.

COL. E. H. SHEPPERD recently retired as comptroller of the United States Shipping Board and has been assigned to do special work with the finance department.

L. M. STEVENS, of Philadelphia, formerly general auditor of the United States Shipping Board, has been appointed to succeed Col. E. H. Shepperd as comptroller of the board.

CAPTAIN FRANCIS H. ROBINSON, for the past three years president of the National Interocean Corporation, has been made general freight agent of the Williams Line in New York.

B. L. MCMULLEN has been named Seattle manager for the Crowell & Thurlow Steamship Company. He was formerly in charge of the Sudden & Christensen agency at Portland, Oregon.

CHARLES F. DUISENBERG has been appointed San Francisco agent for the North German Lloyd Steamship Company. This company has not been represented in San Francisco since 1916.

FRANK S. DICKSON, for some years adjutant-general of Illinois, has been selected by President Harding to become assistant treasurer of the United States Shipping Board and Emergency Fleet Corporation.

HENRY CAVE, formerly with the London branch of the Shipping Board, has been appointed superintending engineer of the Stockholm district with offices at Stockholm, Sweden.

W. E. GRIFFITH, district director of the Hampton Roads district, has been appointed to the position of manager of the operating department of the United States Shipping Board Emergency Fleet Corporation with headquarters at Washington.

C. J. JANSSEN has been made freight traffic manager of the United States Navigation Company of New York. He was formerly export freight contractor with R. D. White & Company and prior to the war was with the Hamburg American Line.

OBITUARY

JAMES TREGARTHEN, president and founder of the shipbuilding firm of James Tregarthen & Sons, died at his home in Brooklyn, N. Y., April 11, at the age of 80 years. He was born at St. Mary's, in the Scilly Islands, England, and served his apprenticeship as a shipbuilder in Newport, Wales. In 1861 he came to America and followed the shipbuilding industry here until his death.

CHARLES L. SEABURY, senior member of the firm of Seabury & de Zafra, Inc., New York, consulting naval architects and marine engineers, died at the New York Hospital, April 7, at the age of 62. He was born at Tiverton, R. I., in 1860, and at an early age began work in the Herreshoff yacht works at Bristol. Later in New York he was with the Gas Engine & Power Company, builders of small boats. Here he was instrumental in developing the naphtha engine, forerunner of the gasoline motor. When he was 22 years of age Mr. Seabury established his own yacht building company at Nyack, N. Y., to carry on the construction of high speed steam yachts, which later made him world famous. During this period of his career, he produced the Seabury safety watertube boiler which was and still is used where high steam pressures and quick steaming are required. Following this, his business became consolidated with the Gas Engine and Power Company at Morris Heights, N. Y., and for many years he acted as vice-president and general manager of this firm. In addition to yacht work, several torpedo boat destroyers were built at the yard. Under his direction, more than 2,000 yachts have been designed and built, including the *Vitesse, Little Sovereign* and *Sovereign,* the latter having a record speed of 40 miles an hour over the measured mile course. During the war, Mr. Seabury was consulting marine engineer with the Foundation Company at Savannah and New Orleans. For the past three years he has been associated with Carlos de Zafra as a consulting naval architect. Mr. Seabury was a member of the Society of Naval Architects and Marine Engineers and the New York Yacht Club.

Charles L. Seabury

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Shipbuilding, Reconditioning and Operation

Port Expansion, Passenger and Freight Activities and Other Notes of Interest in All Branches of the Marine Industry

The First Quarter

DURING the first three months of 1922 there was reported in the columns of the Weekly Bulletin a total of $34,927,000 in contemplated ship work and $14,930,206 in actual contracts placed, according to figures compiled by MARINE ENGINEERING AND SHIPPING AGE.

Since January 1 of this year the trend of marine activities has been steadily upward both in new vessel construction and the reconditioning of others. Whether or not it is due to the proximity of the expected passage of the Ship Subsidy Bill now awaiting the action of Congress, there is evidence that the second quarter of 1922 will show even more real business activity for ship builders, repair yards, and equipment companies than the first quarter.

Millions of Dollars to Be Spent for the Construction of 22 Ships Which Are Now Well on Way to Contract Stage

Plans of American Shipowners for Business Expansion Indicate Renewed Activity for Shipyards—Programs Contemplated Include Inland and Coastwise Vessels

ACTUAL building operations on the construction of a total of 22 vessels, which will involve the expenditure of many millions of dollars, preliminary announcements concerning which have been previously and exclusively made by MARINE ENGINEERING AND SHIPPING AGE, are expected to begin in the near future, according to latest indications.

FIVE DIESEL BARGES

It is learned that bids have been received and final decision is now under consideration for the placing of a contract for the building of five Diesel-electric propelled barges for the Canal & Rivers Company, 52 Vanderbilt avenue, and designed by R. R. Livingston, marine engineer, of 2 Rector street, New York City.

The boats, which it is expected will cost about $175,000 each, will be 160 feet long with a beam of 36 feet, depth 11 feet 6 inches, and a capacity of 550 tons. Each vessel will be equipped with two Diesel engines driving generators and two motors driving twin propellers. There will be about 280 horsepower in each boat.

THIRTEEN FREIGHTERS

Awarding of a contract for the construction of 13 special type ocean and lake freighters for the Central Steamship & Commerce Corporation, 30 Broad street, announced by MARINE ENGINEERING AND SHIPPING AGE, February 25, 1922, is looked for in the near future. These vessels were designed by Theodore D. Wells, naval architect and marine engineer of 11 Broadway, New York City. They are to be driven by Diesel-electric engines and will be for service through the Welland Canal and New York Barge Canal between New York and Chicago and also to the West Indies when canal traffic is closed.

FOUR PASSENGER SHIPS

Although it is believed it will be several weeks before definite information is available, it is learned that work is being pushed on the preparation of plans and specifications for the two new passenger ships to be built for the Eastern Steamship Company, of Boston, Mass., which are being designed by Theodore E. Ferris, naval architect and marine engineer of 30 Church street, New York City. These boats will cost approximately one million dollars each and are to be about 400 feet in length, driven by double reduction geared turbines turning single screws, with boilers fired by oil burners. They will carry over 700 passengers.

While no official information was given out concerning the new vessels proposed by the Old Dominion Steamship Company, Pier 25, North River, New York, of which Mr. H. B. Walker is president, it is understood that tentative plans will provide an innovation in coastwise passenger and freight service with the establishment of an express route between New York and Norfolk, Va., with at least two ships, each about 400 feet long and capable of making the passage from New York to Norfolk over night.

Philadelphia Marine Exposition

Indications point to the Annual Marine Exposition to be held in the First Regiment Armory, Philadelphia, Pa., from May 8 to 13 inclusive, as one of the most important events of the kind ever held here. More than 100 exhibitors are expected to take part in the affair.

Preliminary Plans Under Way to Recondition the Agamemnon and Mount Vernon

Announcement is made from Washington that the Shipping Board has voted to have W. F. Gibbs, naval architect and marine engineer, of New York, prepare plans and specifications for the reconditioning of the ex-German passenger ships *Agamemnon* and *Mount Vernon*. It is stated that the Board is seriously considering the putting of these ships in service but whether or not the work will be done will depend largely on the estimates of the probable cost.

Proposed Seagoing Dredges Are Receiving Consideration at Washington

Latest developments with regard to the proposed building of six seagoing dredges, at an estimated cost of about $4,500,000, announced in the Weekly Bulletin of February 11, 1922, indicate that the project is receiving the serious attention of the United States Engineer Office at Washington, D. C., and that, according to present plans, four of the six proposed boats will be equipped with Diesel electric machinery. The remaining two will be steam driven.

It is also learned that the Department is working on the preparation of designs for a steam driven dredge of somewhat smaller dimensions than the 247-footers already proposed.

Contract Placed for Construction of River Type Steel Car Ferry

The contract for the construction of a steel side wheel car ferry for use on the Mississippi River has been awarded to the Charles E. Ward Engineering Company of Charleston, West Virginia. The boat is for the Missouri & Illinois Railroad, and was designed by the firm of Cox & Stevens, naval architects, of 25 Broadway, New York City.

The vessel will be 285 feet in length over all, with a beam over guards of 86 feet, and depth of hull 11 feet, draft 5 feet. She will be driven by two simple engines having a diameter of 22 inches and an 8-foot stroke. Steam will be supplied by six river type boilers.

The steamer will be of the three-track ferry type with machinery and boilers on deck. Delivery is scheduled for the latter part of September, 1922.

May Convert Fireboats to Diesel or Gasoline Power

The City of Portland, Ore., C. A. Bigelow, Commissioner of Public Affairs, is investigating the feasibility of converting its oil burning steam fireboats into either Diesel or gasoline equipment.

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Federal Shipbuilding Company Awarded Contract for Building of Merchants & Miners Ships

Vessels Are to Be of Combined Passenger and Freight Type for Service on Atlantic Seaboard—Will Be 368 Feet in Length and Equipped with Modern Improvements

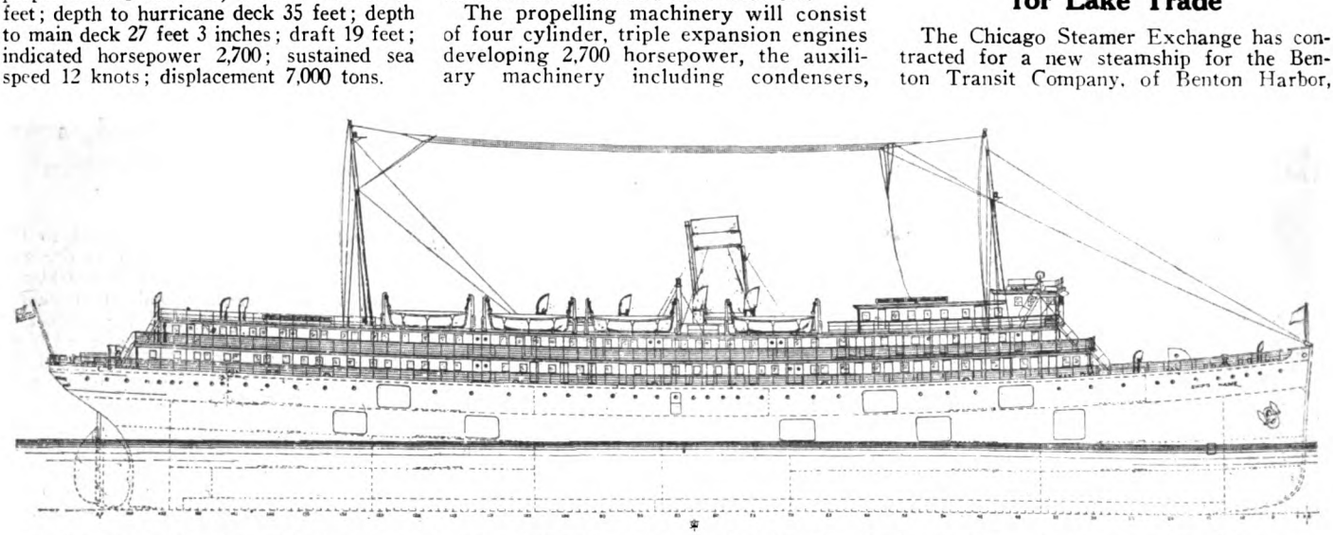
THE Federal Shipbuilding Company of Kearney, New Jersey, has been awarded a contract for the construction of two combination passenger and freight ships for the Merchants and Miners Transportation Company of Baltimore, Maryland. The vessels will be built on the Isherwood system of longitudinal framing.

The type of ship proposed will have an overall length of 368 feet; length between perpendiculars 350 feet; breadth molded 52 feet; depth to hurricane deck 35 feet; depth to main deck 27 feet 3 inches; draft 19 feet; indicated horsepower 2,700; sustained sea speed 12 knots; displacement 7,000 tons.

bulkheads, in accordance with the United States Steamboat Inspection Laws, and the vessels will meet the highest classification of the American Bureau of Shipping. Special attention has been paid to stability and when completed the vessels will be among the safest American passenger ships afloat.

Each ship will be equipped with four, single-ended Scotch boilers equipped with Howden forced draft; oil burners; superheaters and Diamond soot blowers.

The propelling machinery will consist of four cylinder, triple expansion engines developing 2,700 horsepower, the auxiliary machinery including condensers,



Outboard profile of combined passenger and freight ship proposed for the Merchants & Miners Transportation Company of Baltimore, Md., to engage in the Atlantic Coast service.

The ships will be of the combined passenger and freight type and will carry approximately 206 first class passengers in 105 staterooms. Each stateroom will be finished in the most up-to-date manner, the equipment including hot and cold running water, shower baths, etc.

Each vessel will have four complete steel decks which will reduce the fire hazard to a minimum. A system of mechanical ventilation will be installed assuring an adequate supply of fresh air in the staterooms. There will also be

pumps, etc., to be furnished by the builder.

The equipment for each ship will include the following: two 50-kilowatt and one 15-kilowatt generators; one 2-ton ice machine; 10 winches, two on each hatch; hand and steam steering gear; steam windlass; seven 42-passenger lifeboats, and one motor lifeboat, which can tow the others.

The vessels, when completed, are to run between Baltimore or Philadelphia and Savannah or Jacksonville.

Million Dollars Worth of Business Placed with Order for Construction of Three Steel River Type Steamers

THE Louisville & Cincinnati Packet Company has contracted with the Midland Barge Company, of Pittsburgh, for three large side-wheel steel steamers, which it is expected will cost close to $300,000 each.

One steamer, which will be named the *America*, will be used for excursion purposes. This vessel will be 285 feet long with 45 feet beam. She will be equipped with the Mississippi River type of boilers and high pressure, non-condensing engines.

The other two vessels, which will be combined passenger and freight boats, will have a length of 300 feet and a beam of 45 feet. They will be placed on a regular run between Cincinnati and Louisville and will have stateroom accommodations for 175 passengers. It is expected these vessels will make the run of 131 miles between Louisville and Cincinnati in six hours.

Steam will be generated in eight flue boilers. It has not been decided whether single engines of 30-inch diameter and 10-foot stroke or compound engines will be used.

Great Lakes Plant Gets Contract for Construction of 605 Foot Freighter

The Wilson Transit Company of Cleveland, Ohio, has placed an order with the Great Lakes Engineering Works, of Ecorse, Michigan, for a bulk freighter of the arch type construction. The vessel is to be 605 feet over all length, with 60 feet beam and 32 feet molded depth. She will be driven by a triple expansion engine with cylinders 34½, 40 and 65 inches diameter and 42-inch stroke.

Steam will be supplied by three Scotch boilers, 11 feet by 13 feet 6 inches. The ship will carry 12,500 long tons on 20-foot draft. Delivery is scheduled for the middle of September.

New Steamer Contracted for by Benton Transit Company for Lake Trade

The Chicago Steamer Exchange has contracted for a new steamship for the Benton Transit Company, of Benton Harbor, Mich., which will enter the lake trade this summer. The steamer, building at East Booth Bay, Maine, will be in service by June 1.

She will be 152 feet long, 30 feet wide, provide berths for 100 passengers, and have a freight capacity of 350 tons.

All the machinery is being furnished by manufacturers of Lake Michigan ports. The boat will have a steel turtle-shaped deck forward and command the lowest insurance rate.

Babcock & Wilcox Company Earns $9.29 a Share in 1921

The annual report of the Babcock & Wilcox Company, for 1921, shows net income after charges, Federal taxes and inventory adjustments of $1,394,589, equivalent to $9.29 a share earned on the 15,000 shares of capital stock outstanding, compared with net income of $2,207,803, or at the rate of $14.71 a share in the preceding year.

Gross profit totaled $2,101,061, against $4,281,866 in 1920.

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Construction of Ten to Fifteen Self Propelled Oil Carriers for South American Service Contemplated

Four to Six Million Dollars May Be Expended for Special Type of Steel Ship—Preparation of Plans Believed to Be in Preliminary Stages

THE possibility of the placing of an order for the construction of from 10 to 15 self-propelled steel oil tankers of a specialized type, at a total cost which it is believed will range from four to six million dollars, is the latest new ship construction prospect for 1922, according to information obtained by MARINE ENGINEERING AND SHIPPING AGE.

It is learned that the New England Oil Refining Company, 25 Broadway, New York City, is contemplating the construction of such boats for service between Maracaibo Lake and other Venezuelan ports and possibly Tampico or other oil centers of Mexico. While no definite or detailed information was obtainable with regard to the present status of these contemplated ships, it is reported that a prominent New York naval architect has been consulted with a view to preparing tentative plans of a type of vessel suitable for such service.

It is thought that the proposed carriers will be about 350 feet in length and to meet the requirements they would probably have a draft of 10 or 11 feet in order to make the passage to and from Maracaibo Lake. The propelling machinery will very likely consist of internal combustion engines developing from approximately 800 to 1,000 horsepower, giving the vessels a speed of 8 or 9 knots.

Many Contracts Being Placed for Leviathan Equipment

The work of reconditioning the steamship *Leviathan*, which will involve a total expenditure of $8,200,000, is well under way at the plant of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va.

Among the contracts for materials and equipment, which have been placed by the shipbuilding company in conjunction with the *Leviathan* contract, the following are included to date:

For steel plates and shapes, gyro compass equipment, insulated safety wire, copper pipe, main electric generator, tubes for auxiliary condenser, aero fire alarm system, monel metal bars, brackets, fans, air pressure gauge, forged steel flanges, torsion meters, tubes for drainage condenser, fuel oil meters, forced draft blowers, hardware, electric lighting fixtures, electric clock cases, plumbing fixtures, fire hose, fuel oil burners, pumps, donkey boiler, and iron and steel pipe.

City of Tampa, Fla., to Vote May 23 on $600,000 Port Bonds

The ordinance officially calling a city election for May 23, for voting on $600,000 bonds for completion of the municipal port terminals, has been passed by the city commission of Tampa, Fla. The ordinance provides for the issuance and sale of bonds, for the expenditure and disbursing of the funds from the sale of the bonds, and calls the election to authorize the same. It provides that when sold, the money be used for building municipal docks or wharves, railroad tracks, warehouses, etc., on the west side of the Ybor estuary, and any money left shall be used only for further improvement and development of the harbor, and the city's waterfront property.

City Manager Hall's estimates include the following: Two thousand four hundred thirty-five lineal feet concrete docks and bulkhead at $175 per foot, $426,125; freight warehouse, one-story, $70,000; cranes, trucks, etc., for loading and unloading, $40,000; water supply, office building and other expense, $30,000; total, $566,125.

Aberthaw Construction Company Gets $271,416 Job on Portland Pier

The contract for the construction of the substructure of the State pier at Portland, Me., was awarded on March 10 to the Aberthaw Construction Co., of Chelsea, Mass., on the company's tender of a price of $271,416.75.

Initial development calls for a pier 1,000 feet in length, 144 feet in width at its outer end, 236 feet in width at its inner end with the dock between the proposed pier and Atlantic Wharf to be 250 feet in width. The berth adjoining the pier will be dredged to a depth of 35 feet at mean low water for a width of 125 feet and the berth adjoining the Atlantic Wharf to a depth of 30 feet, gradually deepening to 35 feet at the property line. The plans and specifications were prepared by Fay, Spofford and Thorndike, of Boston, Mass., consulting engineers.

It is expected that the pier will be in operation early in 1923.

Creole Awarded to Robins Plant for Reconditioning

The contract for the reconditioning and conversion of the Southern Pacific steamship *Creole* from coal to oil burning was forwarded on April 11 to the Robins plant of the Todd Shipyards Corporation, Brooklyn, N. Y. Besides the conversion of the fuel system the work includes the rearrangement of boilers, reconditioning of passenger accommodations and the building of additional passenger quarters at a total cost of close to $200,000.

Big Dredging Job Proposed for Delaware River

United States Engineer Office, Room 815 Witherspoon Building, Philadelphia, will receive sealed proposals until 12 o'clock noon, May 18, for dredging in the Delaware River on the Liston Range.

The work to be done consists of the construction of a channel having a least bottom width of 800 feet, a least depth of 35 feet at mean low water and a length of approximately 7,000 feet. The estimated quantity of material to be removed, including allowable overdepth, is 1,476,600 cubic yards, scow measurement.

Baltimore to Spend $50,000,000 For Development of Its Port Facilities; $10,000,000 of Fund Authorized

THE Port Development Commission of Baltimore, Maryland, after several months' work, has made public the tentative plans for the proposed development of the Baltimore port. The total port loan amounts to a sum of $50,000,000.

The Public Improvement Commission now has $2,200,000 available for immediate use in the development of the harbor. With the cooperation of the Improvement Commission, the Port Commission will have the use of this sum at its command. Ten million dollars of the total sum of $50,000,000 has already been authorized and as soon as leases are made will be available. When the leases are made a part of this loan can be used to replace amounts advanced by the Public Improvement Commission. Thus a revolving fund will be kept intact for working capital and the Port Commission would be able to immediately begin the improvements in accordance with the plans.

TENTATIVE PLANS

At the northern extremity of the bulkhead will be a long marginal wharf and south of this a series of five piers.

Tentative developments for the eastern side of the harbor show eight piers on the Canton Company's property, but the policy of the commission is to expend its principal efforts on the western side of the river. If lessees should be found for piers on the Canton Company's property, piers will be built in accordance with the layout plans, after the property for them is acquired by the city.

The city owns a big block of property on McComas Street and it is proposed to concentrate there first. Other property will have to be acquired in order to carry out the commission's plan. All the waterfront on the south side of Locust Point, from the Western Maryland piers at Port Covington to Fort McHenry, will be required for the carrying out of the McComas Street project. Practically two whole blocks of this site are owned by the Baltimore and Ohio and the Bethlehem Shipbuilding Corporation, Bethlemem, Pa.

PATAPSCO DEVELOPMENT

It will be necessary to confine the channel of the Patapsco River where it overflows the mud islands and flats to the south shore and also to acquire property owned by Arundel Corporation or compensate them for practical loss of waterfrontage, in order to carry out the plan for the Patapsco group on the mud islands behind Hanover Street bridge and the proposed fill in front of the bridge. The layout as planned cuts off the Arundel property entirely from development for pier purposes.

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Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPS AND SHIPBUILDING

Ship Purchase, Seattle, Wash.—Alaska Steamship Company, Seattle, Wash., is in the market for purchase of a passenger and freight ship for service between Seattle and Alaskan ports. Intention to build apparently abandoned. Three thousand ton ship probably needed.

Repair Contract, New Orleans, La. Repairs to damage to Standard Oil Company's tanker Pioneer, caused by collision with seawall at Tampa, Fla., awarded Jahncke Dry Dock Company, New Orleans. Repairs: Installing new stem, fairing of vessel's forefoot, renewing 24 plates on bow, drydocking and painting.

Fireboat, West Coast.—New York naval architect understood to be preparing tentative plans and specifications for fireboat for a city on west coast. It is believed proposed boat will be about 125 feet long with Diesel engines, 600 indicated horsepower, and capacity of 10,000 gallons per minute. Estimated cost is $300,000.

New Ferry, New York.—Report in New York marine circles that West Shore Railroad is considering construction of new ferryboat developed that while new boat had been contemplated time of definite action is not certain.

Steel Ferry, British Columbia.—Canadian National Railways Grand Trunk Pacific Dry Dock, Prince Rupert, B. C., reported as having secured order from British Columbia Public Works for steel ferry to operate on Francois Lake about 250 miles inland along Grand Trunk Pacific Railway, boat to be fabricated and assembled at plant and shipped to lake for completion. Contract includes construction of wooden cradle to be built on marine ways and installed by Public Works Department.

New Ship, Welland, Ont.—Collingwood Shipbuilding Company, Collingwood, Ont., received order from National Sand & Materials Company of Welland, Ont., of which David Dick, Jr., is president, for special type steamship for securing and carrying sand and gravel. The vessel will be about 258 feet long, deadweight carrying capacity of 3,000 tons, single screw, driven by triple expansion surface condensing steam engine with two boilers having 180 pounds working pressure.

Oil Burner, Los Angeles, Cal. Clyde's sailing ship Falls, formerly operated by the Matson Navigation Company, in run from San Francisco to Philippines and Hawaii, will be converted into oil barge, operating out of Los Angeles harbor.

Recondition Steamers, San Francisco, Cal.—Thomas L. Wand and Wellesley, steam schooners purchased by John C. Ogden, to be reconditioned at San Francisco, will probably be equipped with Diesel engines and other changes made before they are placed in coastwise lumber trade.

Construction Contract, New York. Tebo yacht plant of Todd Shipyards Corporation was awarded contract for construction of steel Diesel-engined yacht to be built to designs of Cox & Stevens for Merrill B. Mills, of Detroit. Dimensions: 129 feet over all length, 23 feet beam; two Diesel type, six-cylinder, four-cycle Winton engines, each developing 225 brake horsepower.

Pile Driver Hull, Tampa, Fla. The Tampa Shipbuilding and Engineering Company of Tampa, Fla., with price of $4,500 was low bidder for pile driver hull for United States District Engineer office at Montgomery, Ala., at opening of bids in that office on March 20.

Construction Contract, Wilmington, Del. The Bethlehem Shipbuilding Corporation, Ltd., was awarded the contract for construction of an ocean-going auxiliary yacht for Keith Spalding, of Chicago. Delivery scheduled for first of October, 1922; vessel 161 feet long, designed by Henry J. Gielow, Inc.

Fireboat Conversion, Portland, Ore. City of Portland, Ore., C. A. Bigelow, Commissioner of Public Affairs, is investigating feasibility of converting its oil burning steam fireboats into Diesel or gasoline equipment. City maintains two fireboats: one, 125 feet long, capacity of 9,000 gallons per minute; the other, 115 feet long, capacity, 6,000 gallons per minute.

Contract Award, New York.—G. E. Engineering Company, 449 West 42nd St., New York, was awarded contract for steam supply system, specification 4586—Bureau Yards and Docks, Navy Department, Washington, D. C., price $168,300 (150 days) less $86,100 (30 days), item 6 (deduction made if two 250 horsepower boilers are furnished by Government), making total award of $71,300 (120 days).

Diesel Engine Installation.—Announcement made from Seattle that Pioneer Towing Company, engaged in Puget Sound—British Columbia, towing for years and now enlarging operations in Sound log towing industry, has converted one of its tugs into Diesel-powered vessel and will make similar installation in another boat of same type.

Construction Contract, West Virginia.—Contract for construction of steel side wheel car ferry for use on Mississippi River awarded to Charles E. Ward Engineering Company, of Charleston, W. Va. Boat is for Missouri & Illinois Railroad, designed by Cox & Stevens, naval architects, 25 Broadway, New York. Dimensions, 285 feet long, beam 86 feet, draft 5 feet.

Seagoing Dredges.—Latest developments regarding proposed building of six seagoing dredges, estimated cost $4,500,000, indicate the project is receiving serious attention of United States Engineer Office, Washington, D. C., and according to present plans, four of six proposed boats will be equipped with Diesel electric machinery, remaining two to be steam driven. Department also working on preparation of designs for steam driven dredge of somewhat smaller dimensions than 247-footers already proposed.

Repair Contract Award, New Orleans, La. F. W. Hoodey Iron Works, New Orleans, awarded contract for repairs to Shipping Board steamer Youngstown.

Contract Awards, New Orleans, La. Johnson Iron Works, Dry Dock & Shipbuilding Company, Inc., New Orleans, La., was awarded three jobs for repairing and general overhauling on steamships Tegucigalpa, Ceiba and Yoro, of Vacarro Bros. & Company Lines. All three vessels were docked, scraped, painted, tail shafts drawn, and pintles examined, along with numerous other repairs.

Coastwise Towing Job.—W. G. Coyle Towing Company of New Orleans, La., contracted with J. W. Sullivan of New York, to tow from New Orleans to Jacksonville, Fla., Ferris type wooden ship Abergfoil, to be converted into barge. The new ocean going tug DeBardeleben, formerly Bertherry, was scheduled for towing job. Same company reported as engaging with Sullivan concern to tow the steel barge Nashville from New Orleans to New York, to be used in Long Island Sound service.

Reversing Rudder Installation, Bridgeport, Conn. McNab Company of Bridgeport, Conn., delivered to Hildebrant Dry Dock Company, South Rondout, N. Y., one of their Kitchen's Patent Reversing Rudders, measuring 66 inches by 77 inches, for installation on 70-foot tow boat building at Hildebrant yard to order of Transmarine Corporation. The tow boat will be driven by 170 brake horse power Nelseco Diesel, six-cylinder submarine engine, non-reverse type.

Possible Construction of Oil Carriers, New York.—New England Oil Refining Company, 25 Broadway, New York, contemplating construction of from 10 to 15 self-propelled steel oil tankers of specialized type, total cost ranging from four to six million dollars. Dimensions: 350 feet long and probably a draft of 10 or 11 feet.

Contract Award, New York.—Bethlehem Shipbuilding Corporation, with bid of $157,680, awarded contract for reconditioning steamship Granite State for service in United States Lines. Contract provides increasing cabin accommodations, installation of accommodations for about 400 third-class passengers in rooms.

To Construct Steel Barge, Algiers, La.—Johnson Iron Works, Algiers, La., awarded contract for construction of all steel oil barge for Southern Paper Mills Corporation, Moss Point, Miss. Dimensions: 144 feet long, 32 feet beam.

Ship Construction, Boston, Mass.—It is learned that the North Atlantic & Western Steamship Company, Boston, Mass. (Nawsco Line), contemplates addition of six motorships to fleet, type similar to American motorship William Penn, apparently held in high favor.

Possible Construction.—Old Dominion Steamship Company is said to be considering building two new passenger and freight ships, coastwise type.

Repair Contract, Mobile, Ala.—Alabama Dry Dock Company awarded steamship Bayo Chicago repairs, work consisting of repairing bow damaged in collision with steamship Antinous. Also awarded contract for repairs on steamship Trinidadian, tanker of Gulf Refining Company.

Contract Awards, Hoboken, N. J.—W. & A. Fletcher Company, Hoboken, N. J., awarded contracts for Eastern Craig, Benjamin Brewster, San Pablo and Sixaolo, drydocking and various repairs. Total about $7,900.

Shipping Board Contracts.—Steamers McKeesport and Bremerton awarded Federal Shipbuilding Company for repairs; McKeesport, $7,899, and Bremerton, $6,238.

Keel Laying, Alameda, Cal.—Alameda plant of Bethlehem Shipbuilding Corporation laid keel for 20,000-ton ore carrier, April 15, beginning of work on first of two steamers on West Coast.

Contract Awards.—Bethlehem Shipbuilding Corporation awarded steamer Eastern Sea, $6,097; Chappaqua, $1,246. Curtis Bay Copper and Iron Company also received award from Shipping Board of the West Gotomska for repairs, at $7,377.

Motor Craft.—Six 50-foot motorboats being built at Navy Yard, Norfolk, Va., competition with Mare Island, probably be completed by July 1, contingent on promptness of delivery of five engines from Portsmouth, N. H. Engine for one of boats arrived and wood necessary in construction of boats received from New York. Receipt makes possible trying out of first boat at early date. Probable cost of boats, $16,000 each.

Steamship to Be Repaired.—The Mazama, damaged by Lewis Luckenbach, drydocked at Sun Shipyard for miscellaneous repairs.

To Be Reconditioned. Shipping Board steamship Egremont, laid up some time, taken over by Kerr Steamship Company, now at Newport News Shipbuilding and Dry Dock Company's yards for repairs. Upon completion, soon, to be taken to New York and placed in service between that port, Norfolk, and India.

Repair Contract.—Contract for repairs to steamer Heffron awarded by Shipping Board to Robins Dry Dock & Repair Co., price $11,000.

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SHIPYARDS AND DRY DOCKS

Shipyard Sold.—Maryland Dry Dock Company took over operation of plant of Globe Shipbuilding and Dry Dock Company, April 1.

Shipyard Restored.—Winnisimmet Marine Railway and Shipyard restored to activity after period of idleness, with hauling out of Ransom B. Fuller, of Eastern Steamship Lines. Winnisimmet yard, one of marine projects of war, situated on Marginal St., Chelsea, Mass., Railway, built at cost of $600,000, can haul large draft ships.

Shipyard Bought.—Plant of Beaumont Dry Dock and Shipbuilding Co., one of largest in Texas, purchased by Petroleum Iron Works Co. New owners to transform plant into one for building fabricated vessels, steel oil tanks and railroad rolling stock, probable actual operation this month. Plant erected during war, turned out many vessels during that time. Complete in every detail, considered one of largest plants of kind in that section of country. Petroleum Iron Works Co. will enlarge plant, make other improvements not in deal. Said that company has contracts already for hundreds tons of steel for steel tanks in this country and Mexico.

PORT IMPROVEMENTS

Seawall, Anona, Fla.—Contract for constructing seawall at Haven Beach awarded to A. T. Le Vasconte.

Pier, Biloxi, Miss.—Plans submitted to Chamber of Commerce for building amusement pier; J. H. Etter interested in building.

River Terminals, Memphis.—City plans construction of river terminals and warehouse. Issue $150,000 bonds. Address Rowlett Paine, mayor.

Harbor Development.—Broward County Commissioners, Fort Lauderdale, Fla., to construct ocean inlet, deepen local harbor, $100,000 bonds voted.

Inlet, Jetties, Etc.—Jupiter Inlet, District Palm Beach County, Fla., to construct inlet, jetties, deepen water way; approximate cost $80,000 to $100,000.

Seawall, West Palm Beach, Fla.—D. E. O'Hara received contract from Palm Beach Company, $30,000, to construct concrete seawall at El Cid, C. H. Ruggles, engineer.

Levee.—Four mile levee to protect Carter Lake District and East Omaha land, planned by Pottawattami County, Ia. (Council Bluffs), and Douglas County, Neb. (Omaha), $175,000.

Seawall. Contract awarded Burns Dredging Co., Sarasota, Fla., to build 3,700 foot seawall around Cedar Point, reclaiming 22 acres; approximate cost of seawall $50,000, dredging $26,000.

Wharves.—City of Orange, Tex., has sold $240,000 bond issue for construction of 800 feet additional wharves, modern warehouses, and various other improvements. Address the mayor.

Loading Facilities.—Humble Oil & Refining Co., Houston, Tex., reported planning construction of loading station, skeleton wharves, and probably two storage tanks at mouth of Neches River, Texas.

Levee.—Red River, Atchafayala and Bayou Boneff Levee Board awarded contract to H. Devill & Co., Marksville, Miss., to construct 57,000 cubic yards levee in island district between Alexandria and Boyce, price $13,000.

Wharf Dock.—Contract awarded by District Commissioners, 509 District Building, Washington, D. C., to Cambridge Manufacturing Company, Cambridge, Maryland, for wharf dock at Water St., between M and N streets, price $14,260.

Harbor Improvements, Houston, Tex.—Thomas H. Ball, chairman of Harbor Board, reports $1,000,000 may be available next 12 months for ship channel development; project calling for 10-foot channel, 60 feet wide from turning basin to foot of Main street.

Contract Award.—Contract for pile foundations of new Norfolk grain elevator awarded by City Port Commission to Sanford & Brooks, Norfolk, price $62,941.30. Foundation will require nearly 3,000 piles; includes in specifications cofferdam, $14,000, at cost of city expense, $12,500.

Levee, Clarksdale, Miss.—Proposed construction of 21 miles of levee, extending from Brunswick to point opposite Vicksburg, approved by Yazoo Mississippi Delta Levee Commissioners; estimated cost $1,500,000, reclaiming about 250,000 acres land in Sharkey, Holmes, Leflore, Yazoo and Humphrey counties.

Pier Contract Award.—City of Philadelphia, Department of Wharves, Docks and Ferries, awarded contract for construction, with appurtenant work, of superstructure, Porter Street Pier, No. 84 South Delaware River, to Franklin M. Harris & Co., 1518 Parrish St., Philadelphia, Pa., price $1,674,515. Superstructure to be two-story steel and reinforced concrete structure.

Warehouse and Superstructure, Havana, Cuba.—Havana Docks Corporation, Havana, Cuba, awarded Turner Construction Company, 224 Madison Ave., New York, contract for construction of 5-story warehouse and 2-story superstructure on pier in Havana harbor. Pier is 580 feet long and job runs into several millions of dollars.

Dredging, Delaware River. United States Engineer Office, Room 815, Witherspoon Building, Philadelphia, to receive sealed proposals until 12 o'clock noon, May 18, for dredging in Delaware River on Liston Range. Work consists of construction of channel having least bottom width 800 feet, least depth 35 feet at mean low water and a length approximately 7,000 feet. Estimated quantity of material to be removed, including allowable overdepth, is 1,476,600 cubic yards, scow measurement.

Harbor Improvement, Beverly, Mass.—Beverly, Mass., to get $98,000 additional in schedule for new river and harbor improvements for widening and deepening the channel and improving harbor conditions. Schedule calls for estimated expenditure of approximately $31,100,000 authorized under bill ordered reported by House Rivers and Harbors Committee in Congress. Bill provides only for new projects and, if enacted, would require subsequent passage of appropriation bill providing funds for various projects. Besides the Government appropriation, city has already appropriated $25,000 and State has made $50,000 available for work.

NEW INCORPORATIONS

It is reported from Richmond, Va., that the Newport News Shipbuilding and Drydock Company has increased its capital from $12,000,000 to $26,000,000.

Ocean Carriers Co., Manhattan, $35,000; J. L. Watson, F. H. Butchorn, T. E. Halle (attorney, F. J. Knorr, Albany).

Florida Dredging Company, Miami, Fla., capital $75,000; C. L. Crandall, president, B. K. Crowell, secretary and treasurer.

A. D. N. Steamship Corp., Manhattan, $15,000; R. J. Sykes, M. Roger, W. H. Gillon (attorney, P. Boyninge, 111 Broadway).

Gore & Hanley, Manhattan, navigation, $5,000; A. G. Gore, W. Hanley, W. Ostrander (attorney, P. Baumer, 15 Whitehall St.).

Megathlin & Clark Dredging Co., Miami, Fla., capital $50,000; J. L. Megathlin, president, J. T. Rambler, secretary and treasurer.

Murray Harbor Transportation Co., Brooklyn, $150,000; J. J. Murray, T. J. Boyce, J. D. Carroll (attorney, J. P. Carroll, 189 Montague St., Brooklyn).

Gladding Express Co., Steamship Line, Baltimore, Md., Pier 4, Light St., increased capital to $100,000; establish steamer service between Baltimore and Cambridge.

Nidaros Steamship Company, 605 Water St., Baltimore, Md., capital $200,000; E. Garrett Atkinson, 105 Singer Ave., August Olsen and O. Legard Jones, incorporators.

Consolidated Fuel Company of New Orleans, La., organized for purpose of bunkering ocean going ships and tow boats. Company will have following officers: H. C. McCormack, president; Robert P. Hyans, vice-president; H. C. Whiteman, vice-president, and Charles Harrington, sales manager.

Floridian Trading Corp., Steamship Line, Jacksonville, Fla., capital $150,000, chartered with Emory C. Meek, president; F. I. Maynard, secretary; E. K. Sharlow, treasurer; steamship lines to Havana, Cuba, Porto Rico and Venezuela ports.

FOREIGN ACTIVITIES

Launching of Steamer, Hamburg.—Built for the Deutsche-Australische Dampfschiffs Gesellschaft, steamer Cassel, 9,000 tons, has been launched from Kockum shipyard at Malmo.

Motor Shipbuilding in 1921, Holland.—Of total of about 500 large and small craft built in Holland during 1921, nearly 70 vessels under 500 tons were propelled by internal-combustion machinery.

Order for Ten Steamers, Russia.—Russian Soviet Government has given order to newly opened Anglo-Baltic Shipbuilding and Engineering Company, at Reval, for ten steamers, work to begin at once.

Order for Floating Dock, Rotterdam.—The Rotterdamsche Droogdock Maatschappij has placed order with Burgerhout Engineering and Shipbuilding Co., Rotterdam, for construction of 8,000-ton floating dock.

Delivery of Tugboat, Rotterdam.—Tugboat Schiedam, built by Messrs. J. and K. Smit, at Kinderdijk, Holland, for Messrs. L. Smit and Co.'s Sleepdienst, Rotterdam, just delivered to owners. Fitted to burn oil fuel or coal, the vessel has a length of 71 feet, breadth of 19 feet, and depth of 9 feet 9 inches.

Proposed Ship Construction, Australia.—The State Government of Western Australia propose construction of Diesel engined ships of 4,000 tons for conveyance of approximately 2,500 tons of frozen meat in addition to other cargo and approximately 175 passengers. Vessels to be built in Scotland, but probably not until headway is made with scheme to establish new harbor and rail center on King's Sound, Western Australia.

Ship Completion Work, Belgium.—Work resumed on Red Star passenger liner Belgenland, designed for Antwerp trade, passenger capacity of 3,000, to register 26,000 tons. She is largest ship to ply in Belgian waters. At time of war she was turned into transport with no passenger accommodations. Her maiden voyage is contemplated in spring, 1923. Built by Harland & Wolff, the ship is 670 feet long, 75 feet wide, speed 18 knots.

Biggest Motorship Proposed, Germany.—In addition to 9,000-ton cargo vessel now being built for North German Lloyd's, equipped with machinery of 3,200 horsepower, Norddeutscher Lloyd have under consideration construction of intermediate cargo ship, 9,000 tons gross, with speed of 12½ knots. The ship would perhaps be largest motor passenger liner in world, although Scandinavian-American Line intends to build an 18,000-ton ship of this class when circumstances become more propitious.

Ship Construction, Sweden.—Approximately 55,000 tons of shipping were launched from Swedish shipyards during 1921, increase of 12,000 tons over previous year. On Jan. 1, 1920, vessels totalling over 100,000 tons were under construction. Motor ship rapidly gaining ground, however, in Scandinavia, no less than 42,530 tons of ships now nearing completion being of this type, compared with 12,220 tons of steamships. Total tonnage, Swedish mercantile marine, January 1 this year, estimated 1,090,000 tons, about 1.73 per cent of world's merchant shipping, decline of 55 per cent from 1914 figures.

May Build Six Vessels, England.—Anglo-Saxon Petroleum Co., London, has invited tenders for construction of one, three, and six motor vessels, 2,800 tons deadweight, 270 feet long, 46 feet 6 inches wide, 23 feet deep, and 17 foot draft, speed 10¾ knots. To be constructed for carriage of refined cargoes, propelled by single six-cylinder four-cycle Diesel engines. Deck auxiliaries and steering engine to be steam driven; large donkey boiler fitted in engine-room. Two steam driven cargo pumps, large size to be installed, and 8 inch double pipe lines fitted throughout cargo tanks.

Steamer Launching, England.—The Northumberland Shipbuilding Co., Ltd., launched from their shipyard at Howdon-on-Tyne the steamer Eastmoor, building to order of Messrs. Moor Line, Limited (Messrs. Walter Runciman & Co., Ltd.), Newcastle-on-Tyne, Thursday, March 30. She is shelter deck type, 415 feet long, 53 feet wide, 35½ feet molded depth, carrying about 9,250 tons deadweight on 26 feet 3 inches draft, built to Lloyd's highest class. Propelling machinery supplied by North Eastern Marine Engineering Co., Ltd., Wallsend-on-Tyne, consisting of set of triple expansion engines, three boilers of 180 pounds working pressure.

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Philadelphia Pier Contracts Awarded Harris Company on Bid of $1,674,515

The City of Philadelphia, Department of Wharves, Docks and Ferries, has awarded the contract for the construction, with appurtenant work, of the superstructure of Porter Street Pier, No. 84 South, Delaware River, to Franklin M. Harris & Company, 1518 Parrish St., Philadelphia, Pa., at a price of $1,674,515. The superstructure will be a two-story steel and reinforced concrete structure. The contract was awarded on March 27, bids being as follows:

Franklin M. Harris & Company, Philadelphia, Pa.	$1,674,515
J. S. Rogers Company, Philadelphia, Pa.	1,730,400
Triest Contracting Corporation, New York City	1,794,080
Hughes-Foulkrod, Philadelphia, Pa.	1,798,450
Frederick Snare Corporation, Philadelphia, Pa.	1,828,400

BUSINESS NOTES

The Air Reduction Sales Co., New York, recently acquired all the assets including the patents, trade marks, and trade names of the Davis-Bournonville Co., Jersey City, N. J. The consolidation brings together two large companies, whose histories have, to a great extent, been the history of the development of the oxy-acetylene welding and cutting industry. The Air Reduction Sales Company is a pioneer in the extraction of gases from the air for industrial use. The Davis-Bournonville Company was organized in 1907. The equipment in the future will be marketed under the trade name of Airco-Davis-Bournonville.

Calvin P. Moon, who has been actively engaged in the shipbuilding industry on the Atlantic seaboard and abroad for many years, has established an office in the Cunard Building, 25 Broadway, New York City, to engage in the business of marine engineering, reports, surveys, and designs for ships.

The firm of Wunsch & TerKuile, recently organized, has an office and warehouse at 302-4 McDougal Street, Brooklyn, N. Y. This organization is a co-partnership of Messrs. J. W. Wunsch and C. V. TerKuile and will act as the selling agents for manufacturers of material-handling machinery and marine equipment.

The Marine Decking & Supply Company has removed its New York office from 44 Water Street to 3 Coenties Slip. Mr. A. B. Jewell is in charge of the New York territory on the tackle block division.

STEAMSHIP INTERESTS

The *Maryland*, built at the Tebo plant of Todd Shipyards Corporation for account of Maryland Pilots' Association, assigned to Cape Henry, Maryland, Station. Trial trip very successful. Vessel has berths for 15 pilots, and left New York for Baltimore on April 12.

Ocean Carriers' Co., Inc., 25 Beaver St., New York, announced new freight service, New York to Portugal and Spain, with fleet of chartered steamships. Service inaugurated April 25, followed by other vessels at regular intervals.

Australia will resume trade with Germany on August 1, ending period of seven years during which embargo on trade with enemy countries was enforced.

Beginning this month monthly cargo service to South and East African ports will be inaugurated. New service under management of Mallory Steamship Lines, Inc., only American line operating on route, and will involve placing six vessels on route. Calls to be made at Cape Town, Port Elizabeth, East London, Durban, Beira and possibly Zanzibar and Mombasa.

TRADE PUBLICATIONS

SAFETY HAND LAMP.—A patent electric safety hand lamp, suitable for use in any danger zone, as aboard oil tankers, is described in a bulletin issued by Watts, Fincham & Company, Ltd., Billiter Building, 22 Billiter St., London, E. C. 3, England. The lamp is gas and watertight and has been approved by Lloyd's Registry of Shipping.

OIL STORAGE.—The recent issue of *The Atlantic Lubricator*, published by the Atlantic Refining Company, Philadelphia, Pa., contains an illustrated feature article on the design, construction and erection of steel oil storage tanks as well as a number of articles dealing with lubricating and oil producing problems.

HAND CUT FILES.—A catalogue listing the various type quality files produced by Murcott & Campbell, Inc., Brooklyn, N. Y., is being distributed. Standard types of pillar and flat files, mill saw files, square and round files, half round, etc., with illustrations and details of numerous special types are given together with sizes and prices. The various "cuts" in general use, as rough, bastard, second cut, smooth, dead smooth and the like are described for the information of those desiring to adopt files best suited to their requirements. Sections of files used to the greatest extent are also shown.

LONDON STEAM TURBINE.—For driving boiler feed pumps and standard types of centrifugal machinery, the London steam turbine has been developed in two bearing units. The application and advantages of this system of drive have been described in a preliminary folder distributed by the London Steam Turbine Company, Troy, N. Y. Complete details of the equipment will be given in a new catalogue which will be published within a short time.

EVAPORATORS FOR BOILER FEED WATER.—The application of evaporators to the purification of boiler feed water by distillation is covered in a general and non-technical manner in bulletin No. 360 now being distributed by the Griscom-Russell Company, New York. This booklet is so written that the application of Reilly self-scaling evaporators to the power plant for the elimination of scale, blow-down, priming, and the like may be readily understood by the executive as well as the engineer.

EXPORT HELPS.—The Department of Commerce, Bureau of Foreign and Domestic Commerce, has issued a booklet outlining the organization and purpose of the new industrial machinery division of the bureau. Every manufacturer who has surplus products which can be exported is recommended to use the service of the new division in extending his foreign business. The research work of the division is extensive and as time goes on will be the source of practically any information that may be required of the selling possibilities of all manner of machine products in the world market.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—Commander J. S. Evans, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York.
Secretary and Treasurer—Daniel H. Cox.

National Asociation of Engine and Boat Manufacturers
29 West 39th Street, New York City.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—E. A. Simmons.
Secretary—Robert B. Lea.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 47 Saville Avenue, Quincy, Mass

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1701 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Enginers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia
Via Carlo Alberto 18, Genova.

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